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Microwave Landing System (MLS) Remote Monitoring Subsystem/ Remote Maintenance Monitoring System

Interface Control Report

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16. Abstract

This document standardizes the communications protocol between the Remote Maintenance Monitoring System of the National Airspace System and Microwave Landing Systems of different design. The interface requirements include the electrical, mechanical, data link control, and application level interface requirements between the Microwave Landing System and the Remote Maintenance Monitoring System. Communications functions specified include the establishment and termination of transmissions, and the structure, format, and encoding of messages and commands for transmission. Additionally the logical unit and datapoint addresses are defined for all Microwave Landing System monitored parameters and status parameters.

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List of Abbreviations

ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange
CMN	Control Motion Noise
COND	Condition Field
DISC	Disconnect Command
DCE	Data Circuit Terminating Equipment
DM	Disconnect Mode
DME/P	Precision Distance Measuring Equipment
DTE	Data Terminal Equipment
ERP	Effective Radiated Power
FA Mode	Final Approach Mode
FCS	Frame Check Sequence
FRMR	Unnumbered Frame Reject Response
H	Hexadecimal
I	Information Transfer Format
IA Mode	Initial Approach Mode
ID	Data Point Identification Number
LU	Logical Unit
LRU	Lowest Replaceable Unit
LSB	Least Significant Bit
MLS	Microwave Landing System
MPS	Maintenance Processor Subsystem
MSB	Most Significant Bit
N(R)	Receive Sequence Number
NRM	Normal Response Mode
N(S)	Send Sequence Number
OCI	Out of Coverage Indication
PFE	Path Following Error
RD	Request Disconnect Command
REU	Remote Electronics Unit
RMMS	Remote Maintenance Monitoring System
RMS	Remote Monitoring Subsystem
RNR	Receive Not Ready
RR	Receive Ready
RTN	Return To Normal
S	Supervisory Format
SDR	Site Data Report
SNRM	Set Normal Response Mode Command
TBD	To Be Determined
TDM	Time Division Multiplex
TWA	Two Way Alternate
TWS	Two Way Simultaneous
U	Unnumbered Format
UA	Unnumbered Acknowledgement Response

1. INTRODUCTION

1.1 Purpose - This Interface Control Report is a guideline for preparing Interface Control Documentation for the Microwave Landing System (MLS) to Remote Maintenance Monitoring System (RMMS) interface. It implements the applicable requirements of FAA-E-2721, NAS-MD-790, NAS-MD-792 and NAS-MD-793 and complements them with specific data storage, messages, and commands that are unique to MLS but are not design dependent. It also contains guidelines for processing and displaying information at the Maintenance Processor Subsystem (MPS).

1.2 Scope - This Interface Control Report defines the data link control and application level interface requirements between the MLS Remote Monitoring Subsystem (RMS) function and the RMMS. Electrical and mechanical interface requirements are not contained in this document. Communications functions specified herein include the establishment and termination of transmissions, and the structure, format, and encoding of messages and commands for transmission. Additionally, the logical unit and data point addresses for MLS parameters and link level protocol for bit-synchronous procedures based on ANSI X3.66 are included.

1.3 Applicable Documents - The following documents are referenced in this interface control report. They are applicable to the RMS/RMMS interface to the extent specified herein.

ANSI X3.4, Code for Information Interchange, (FIPS PUB 1), American National Standard, 1977.

ANSI X3.66, Advanced Data Communication Control Procedures (ADCCP), (FIPS PUB 71, FED STD 1003A), American National Standard, 1979.

EIA-232-D, Interface between Data Terminal Equipment (DTE) and Data Circuit Terminating Equipment (DCE) Employing Serial Binary Data Interchange, Electronic Industries Association, 1986.

FAA Order 6090.1, Development and Implementation of Remote Monitoring Subsystems (RMS) within the National Airspace System, Federal Aviation Administration, 1988.

NAS-MD-790, Remote Maintenance Monitoring System Interface Control Document for the Maintenance Processor Subsystem to Remote Monitoring Subsystems and Remote Monitoring Subsystem Concentrators, Federal Aviation Administration, June 10, 1986.

NAS-MD-792, Operational Requirements for the Remote Maintenance Monitoring System (RMMS), Federal Aviation Administration, 1984.

NAS-MD-793, Remote Maintenance Monitoring System Functional Requirements for the Remote Monitoring Subsystem, Federal Aviation Administration, February 28, 1986.

FAA-E-2721, Microwave Landing System Specification, Federal Aviation Administration, 1989.

2. PHYSICAL INTERFACE

The RMS/RMMS interface shall meet all the electrical and mechanical interface requirements specified in FAA-E-2721, Microwave Landing System Specification.

3. SYSTEM OPERATIONAL REQUIREMENTS

3.1 System Overview - The MLS RMS function provides the capability to remotely monitor the MLS operational status and performance parameters, enclosure environmental parameters and site security, and perform commands to change the MLS operational state, security access, and run integrity checks and diagnostics.

3.1.1 RMS Functions - The RMMS is designated as the primary station and as such controls the sequence of data interchange and recovery operations within the data link. The MLS RMS shall be a separately addressable secondary station and shall perform communication functions as directed by the primary station, including:

(a) Accepting data (commands and messages) from the primary station;
(b) Sending data, status, or other RMS related information to the primary station in response to a poll;
(c) Responding to commands from the primary station;
(d) Performing certification tasks as defined in Appendix B.

3.1.2 Logical Unit Addressing - All of the MLS RMS data are grouped into separately addressable logical units. Each data item within a logical unit (LU) is called a data point. The MLS RMS shall implement the logical units and associated data points listed in Appendix A.

3.2 Polling - The RMS shall respond to three different types of RMMS polls:

(a) Continuous Poll
(b) Scheduled Poll
(c) Specific Poll

3.2.1 Continuous Poll - A Continuous Poll is generated by the RMMS to prompt the RMS to send outstanding messages in order of their priority. (A function also performed by scheduled and specific polls for priority messages.)

3.2.2 Scheduled Poll - A Scheduled Poll requests the RMS to transmit a predetermined set of parameters. In response to a Scheduled Poll, the RMS shall send a Site Data Report (as defined in Section 3.3.6) for each of the following logical units:

(a) RMS Master (equipment status, Appendix A.1)
(b) Terminal (logon status, Appendix A.2)
(c) Integrity and Secondary Parameters (Appendix A.5)
(d) Maintenance Parameters (Appendix A.6)
(e) Environmental Parameters (Appendix A.3)

3.2.3 Specific Poll - A Specific Poll requests the RMS to transmit the data point values for a particular logical unit. In response to a Specific Poll, the RMS shall send a single Site Data Report for the logical unit addressed by the Poll.

3.3 Poll Response Information - Site Data Reports (SDRs) and messages shall be identified by an ASCII function code and contain message data as defined in the following paragraphs. Some messages and an SDR require a condition status code to be included in the message data. The condition status codes defined in Table 3.1 shall be used to describe the condition of numeric data points within normal range and condition data points (code A), alarmed data points (codes C through F), and control mastership status (codes G and H).

Table 3.1 Condition Status

ASCII Code	Description
A	Monitored data point value is at or within the normal limit.
B	Data point is not monitored. For example, those parameters associated with secondary equipment in a non-Category III configuration; those parameters associated with an offline equipment.
C	Monitored value is in the hard alarm state with the data point value above the high threshold value. Also used if a condition data point is in the alarm state.
D	Monitored data point is in the hard alarm state with the data point value below the low threshold value.
E	Monitored data point is in the soft alarm state with the data point value above the high threshold value.
F	Monitored data point is in the soft alarm state with the data point value below the low threshold value.
G	Maintenance Control Granted
H	Maintenance Control Denied

3.3.1 Alarm Message - to report an alarm condition within a logical unit. Multiple alarm conditions for a single logical unit may be sent in a single message by appending the three message data fields for each alarmed data point (up to 500 bytes). However, hard and soft alarms shall not be sent in the same message since they each use a different function code.

Logical Unit #: LU address of data point

Hard Alarm Logical Units: Appendices A.5 and A.3
Soft Alarm Logical Units: Appendix A.6

Function Code: A = Hard Alarm
a = Soft Alarm

Message Data:

	Field	# Bytes
(1)	Data Point ID	1
(2)	Condition Status (Table 3.1)	1
(3)	Value of Data Point	2

3.3.2 Return to Normal (RTN) Message - to report that a previously alarmed data point has returned to normal. Multiple RTN conditions for a single logical unit may be transmitted in the same message by appending consecutive message data fields for each data point (up to 500 bytes).

Logical Unit #: LU address of data point

Function Code: B = RTN

Message Data:

	Field	# Bytes
(1)	Data Point ID	1
(2)	Condition Status = 'A'	1
(3)	Value of Data Point	2

3.3.3 State Change Message - to report that a data point in either the RMS Master LU or the Terminal LU has changed value. Multiple state changes within a LU may be reported in a single message by appending message data.

Logical Unit #: RMS Master LU# or Terminal LU#

Function Code: C = State Change

Message Data:

	Field	# Bytes
(1)	Data Point ID	1
(2)	Condition Status = 'A'	1
(3)	Value of Data Point	2

3.3.4 Terminal Message - to send communications between an on-site operator at the equipment designated by the data point ID (from the Terminal LU) and a remote operator at an RMMS site.

Logical Unit #: Terminal LU#

Function Code: I = Terminal

Message Data:

	Field	# Bytes
(1)	Data Point ID	1
(2)	ASCII Characters	500

3.3.5 Control Message - to report the response to a control mastership request from the RMMS.

Logical Unit #: Equipment Control LU#

Function Code: J = Control

Message Data:	Field	# Bytes
(1)	Data Point ID	1
(2)	Condition Status = G, or H	1

3.3.6 Site Data Report (SDR) - to provide all data point values for a single logical unit. The SDR shall be formed by using a single function code followed by consecutive message data fields appended for each data point in the logical unit, except for logical units that are not available. Each SDR data point shall contain a numeric or ASCII value, and a condition status as defined in Table 3.1.

Logical Unit #: LU# of data to be sent

Function Code: C = SDR Available
g = Not Available; shall be used if logical unit is not accessible (such as due to loss of communication). No message data shall be sent when using this function code.

Message Data:	Field	# Bytes
(1)	Condition Status (Table 3.1)	1
(2)	Value of Data Point	2

3.4 Commands - The RMMS will issue commands to the MLS. All commands except Request Maintenance Control shall be initiated only when the RMMS has control mastership. For all commands, the logical unit address shall be the Equipment Control LU# (Appendix A.15) and the function code shall be "H". The message data shall contain the information specified in the following paragraphs. The command codes are given in hexadecimal; a number followed by H denotes hex.

3.4.1 Equipment On - to turn on the equipment designated by the data point ID.

Message Data:	Field	# Bytes
(1)	Command Code = 20H	1
(2)	Data Point ID	1
(3)	Value of Data Point	2

3.4.2 Equipment Off - to turn off the equipment designated by the data point ID.

Message Data:	Field	# Bytes
(1)	Command Code = 21H	1
(2)	Data Point ID	1
(3)	Value of Data Point	2

3.4.3 Redesignate Primary Equipment - to designate the existing secondary equipment as primary and the existing primary equipment as secondary. This command shall not be valid for single transmitter equipments.

Message Data:	Field	# Bytes
(1)	Command Code = 22H	1
(2)	Data Point ID	1
(3)	Value of Data Point	2

3.4.4 Initiate Equipment Restart - to restart an MLS equipment. This command shall only be valid for those equipments that are shutdown due to an alarm.

Message Data:	Field	# Bytes
(1)	Command Code = 23H	1
(2)	Data Point ID	1
(3)	Value of Data Point	2

3.4.5 Runway Reconfigure - to switch runway direction.

Message Data:	Field	# Bytes
(1)	Command Code = 24H	1

3.4.6 RMS Password Change - to designate a user identifier's password to be changed and provide the new password. This command shall only be valid for existing user id's. The RMS Password Change structure allows 8 ASCII characters for both user id and password; MLS uses only 3 and 5 respectively. The password and user id data shall be transmitted in the least significant bytes of the 8 byte field. The RMS shall ignore the remaining bytes.

Message Data:	Field	# Bytes
(1)	Command Code = 25H	1
(2)	User ID (3 ASCII characters)	8
(3)	Password (5 ASCII characters)	8

3.4.7 Return Monitor to Normal - to select an MLS equipment's monitor to return to normal.

Message Data:	Field	# Bytes
(1)	Command Code = 26H	1
(2)	Data Point ID	1
(3)	Value of Data Point	2

3.4.8 Initiate Monitor Bypass - to bypass an MLS equipment's monitor.

Message Data:	Field	# Bytes
(1)	Command Code = 27H	1
(2)	Data Point ID	1
(3)	Value of Data Point	2

3.4.9 Initiate End-to-End Integrity Check - to perform an MLS equipment end-to-end integrity check.

Message Data:	Field	# Bytes
(1)	Command Code = 28H	1
(2)	Data Point ID	1
(3)	Value of Data Point	2

3.4.10 RMS Reset - to reset the RMS function.

Message Data:	Field	# Bytes
(1)	Command Code = 29H	1
(2)	Data Point ID (=20H; System)	1
(3)	Value of Data Point (=1; RMS)	2

3.4.11 Request Maintenance Control - to request control of an individual equipment or control of all equipments in the MLS ground system (System data point with value of 'MLS'; see Appendix A.15).

Message Data:	Field	# Bytes
(1)	Command Code = 2AH	1
(2)	Data Point ID	1
(3)	Value of Data Point	2

3.4.12 Relinquish Maintenance Control - to return control of an equipment to the MLS (operational control) or to return control of all equipments currently under control of the MPS (System data point with value of 'MLS').

Message Data:	Field	# Bytes
(1)	Command Code = 2BH	1
(2)	Data Point ID	1
(3)	Value of Data Point	2

3.4.13 Initiate Manual Diagnostics - to perform equipment diagnostics.

Message Data:	Field	# Bytes
(1)	Command Code = 2CH	1
(2)	Data Point ID	1
(3)	Value of Data Point	2

3.5 Data Encoding

3.5.1 Numeric Data - All numerical values shall be coded as 16 bit binary numbers exclusive of the decimal point (e.g., a numerical value of 15.3 is transmitted as 153). The most significant bit (MSB) of the binary value shall be designated as the sign bit with a zero representing a positive number. Negative numbers shall be represented in two's complement notation with the sign bit set to one.

3.5.2 Character Data - Character data shall be ASCII encoded, least significant byte first.

4. BIT-ORIENTED DATA LINK PROCEDURES FOR SYNCHRONOUS COMMUNICATION

The MLS RMMS communication link shall support the American National Standard for Advanced Data Communication Control Procedures (ADCCP), ANSI X3.66. The purpose of this section of the Interface Control Report is to identify the specific ADCCP features to be supported by the communication link.

4.1 Operational Summary - The bit-oriented data link control procedures shall be employed for synchronous mode operation. The basic operation shall be set as Normal Response Mode (NRM). The bit-oriented data link protocol shall comply with the ANSI X3.66 standards for Unbalanced Normal (UN) class, with the following exceptions:

(a) Extended Length Frame Check Sequence (FCS) Fields (ANSI X3.66, paragraph 3.5). Only the normal 16-bit FCS will be supported.

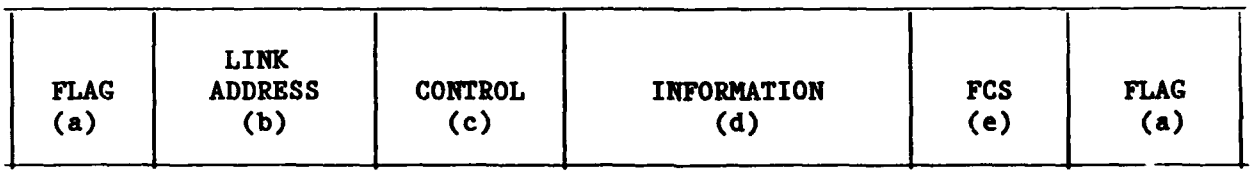
(b) Asynchronous Response Opportunity (ARO) Detection (ANSI X3.66, paragraph 6.2.2) will not be supported.

(c) Asynchronous Response Mode (ARM) and Asynchronous Balanced Mode (ABM) will not be supported. In particular, the following commands are excluded:

(1) SARM
(2) SABM
(3) SARME
(4) SABME
(5) XID

4.2 Frame Structure - All transmissions between the MLS and RMMS shall be in frames and each frame shall conform to the structure shown in Figure 4.1 with bit sequencing in accordance with paragraph 3.11 of ANSI X3.66. A maximum of seven outstanding frames shall be transmitted before frame acknowledgement. The use of Two Way Simultaneous (TWS) or Two Way Alternate (TWA) operation is determined and controlled by the primary station. The use of TWS allows intermediate acknowledgements to be sent by the primary station, allowing up to another seven frames to be transmitted until another acknowlegement.

FIGURE 4.1 Frame Structure



(a) Flag is an 8-bit sequence ('01111110') which delimits the beginning and end of each frame. The flag is used for frame synchronization.

(b) The Link Address is the 8-bit secondary station address. For MLS, the address shall always be the MLS RMS' address. The Link Address shall always have the least significant bit set to 1 as required by FIPS Pub 71.

(c) Control contains a link level command or response and may contain sequence numbers in accordance with ANSI X3.66 paragraph 5.2.1. The encoding of the Control field for the Information Transfer Format, Supervisory Format, and Unnumbered Format are defined in Section 4.2.2.

(d) The Information field (I field) may vary but shall not exceed 504 bytes.

(e) The Frame Check Sequence (FCS) shall contain the Cyclic Redundancy Check (CCITT polynominal described in ANSI X3.66, section 12) sequence.

4.2.1 Code Transparency - A Flag bit sequence ('01111110') is used to delineate each new frame. To prevent data within a frame from being recognized as a flag, the following data encoding shall be performed. The sending station shall insert a binary '0' bit following five contiguous binary '1' bits anywhere in the data stream between the opening and closing flags of the frame. On receiving a binary '0' bit followed by five contiguous binary '1' bits, the receiving station shall inspect the next bit. If it is a binary '0', the five previous binary '1' bits are passed on as data and the '0' bit is deleted. If it is a binary '1' the sequence is either a Flag or an abort sequence. The receiving station shall inspect the next (seventh) bit; if it is a binary '0', the pattern is a flag sequence; if it is a binary '1', the pattern is an abort sequence.

4.2.2 Control Field - The Control field shall be used by the MPS to instruct the addressed RMS to perform a specific link level operation. It is also used by the RMS to respond to the MPS. There are three basic formats defined for the Control field: information transfer, basic supervisory control functions, and special control functions.

FIGURE 4.2 Control Field Formats

CONTROL FIELD BITS	1	2	3	4	5	6	7	8
INFORMATION TRANSFER FORMAT (I)	0	N(S)			P/F	N(R)		
SUPERVISORY FORMAT (S)	1	0	S	S	P/F	N(R)		
UNNUMBERED FORMAT (U)	1	1	U	U	P/F	U	U	U

Where: N(S) = The sequence number of the frame to be transmitted; assigned by sending station (I frame only).

N(R) = Expected sequence number of the next received frame. Set by sending station to indicate it has correctly received all prior I frames.

P/F = Poll (P) for the Command Frames (MPS only) and Final (F) used for Response Frames (RMS only).

The P bit is used by the MPS to:

(1) Provide a transmit opportunity to the secondary (RMS) for the transfer of I frames.

(2) Obtain a response from the secondary (RMS) to a specific command.

The F bit is used by the RMS to:

(1) Indicate the last frame of this response opportunity by the secondary (RMS).

(2) Indicate to the primary (MPS) the next expected frame number (N(R)) where F = 1. If this number is less than expected, the primary will initiate check point recovery (see ANSI X3.66, Section 8.2.1).

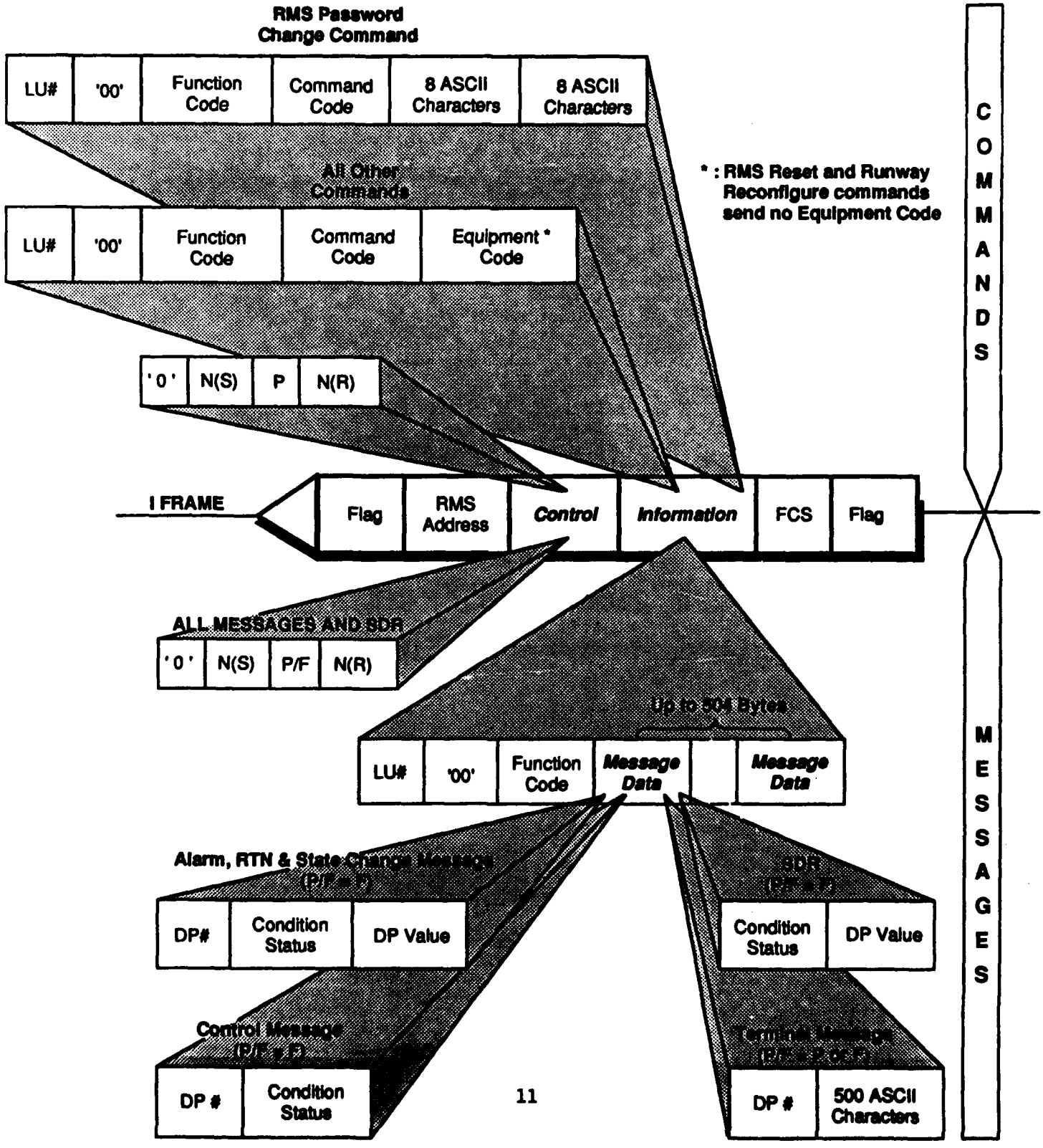
S = Supervisory function bits (bits 3 and 4 of Table 4.1).

U = Unnumbered function bits (bits 3,4 and 6,7,8 of Tables 4.2 and 4.3).

Note: Bit 1 (least significant bit) is transmitted first.

4.2.2.1 Information Transfer Frame (I) Format - The I format shall be used to perform an information or command transfer. Figure 4.3 shows the different I frame Control Field and Information Field contents for MPS commands (upper portion of Figure) and all RMS messages and SDRs (lower portion of Figure).

FIGURE 4.3 Information Control Field Formats



4.2.2.2 Supervisory Frame (S) Format - The S format shall be used to perform link supervisory control functions such as acknowledging I frames, requesting retransmission of I frames, and as an indication of temporary link level interruptions in receiving I and U frames. If the RMS receives an invalid Supervisory Format Frame (any error), the RMS shall not respond. If the MPS receives an invalid response or no response from an RMS, the Retry Procedures as specified in 4.4 shall apply. The definitions and control field assignments for the S frame shall be as shown in Table 4.1.

TABLE 4.1. Supervisory Format Control Field Assignments

		CONTROL FIELD BITS (SEE NOTE)					
RESPONSE	DEFINITION	1	2	3	4	5	6,7,8
RECEIVE READY (RR)	RR is used by a station to: (1) indicate it is ready to receive an I frame and (2) acknowledge I frames numbered up to and including N(R)-1. The Primary station may use the RR command with the P bit set to '1' to solicit responses from a secondary station (continuous poll). An RR frame is one way to report the end of a station busy condition.	1	0	0	0	P	N(R)
RECEIVE NOT READY (RNR)	RNR is used by a station to indicate a busy condition, i.e., the temporary inability to accept additional I frames (see ANSI X3.66, Section 7.2.2).	1	0	1	0	P	N(R)
REJECT (REJ)	REJ is used by a station to request retransmission of I frames starting with the frame numbered N(R).	1	0	0	1	P	N(R)

Note: Bit 1 (least significant bit) is transmitted first.

4.2.2.3 Unnumbered Frame (U) Format - The U format contains no sequence numbers and is used to perform special link control functions. The definitions and control field assignments for the U commands and responses shall be as shown in Tables 4.2 and 4.3 respectively.

TABLE 4.2 Unnumbered Command Control Field Assignments

COMMAND	DEFINITION	CONTROL FIELD BITS (SEE NOTE) 1	2	3	4	5	6	7	8
SET NORMAL RESPONSE MODE (SNRM)	SNRM is used by the MPS to place the addressed RMS in the NRM. Upon acceptance of this command the secondary station send and receive variables are set to zero. Previously transmitted I frames that are unacknowledged when this command is actioned remain unacknowledged.	1	1	0	0	P	0	0	1
DISCONNECT (DISC)	DISC is used by the MPS to perform a logical disconnect to suspend operation with the RMS. The appropriate RMS response to a DISC is a UA. The RMS will respond to subsequent polls with a DM response until receipt of an SNRM.	1	1	0	0	P	0	1	0

Note: Bit 1 (least significant bit) is transmitted first.

TABLE 4.3 Unnumbered Response Control Field Assignments

RESPONSE	DEFINITION	CONTROL FIELD BITS (SEE NOTE) 1	2	3	4	5	6	7	8
UNNUMBERED ACKNOWLEDGEMENT (UA)	The UA response is used by RMS to report the receipt and acceptance of the SNRM, and DISC commands. The UA will not be used to report the end of a station busy condition.	1	1	0	0	F	1	1	0
REQUEST DISCONNECT (RD)	The RD response is used by RMS to report to the MPS that it requests to be placed in disconnect mode.	1	1	0	0	F	0	1	0
DISCONNECT MODE (DM)	The DM response is used by RMS to request the MPS to issue a mode-setting command (SNRM) or if sent in response to a SNRM, to inform the MPS that the RMS is still in DM and cannot execute the SNRM command.	1	1	1	1	F	0	0	0
FRAME REJECT (FRMR)	The FRMR response is used by RMS to report an error condition not recoverable by retransmission of the same frame. For example: 1. Control is invalid. 2. Information field exceeds maximum length. 3. Invalid N(R) number from MPS.	1	1	1	0	F	0	0	1

Note: Bit 1 (least significant bit) is transmitted first.

4.3 Polling and Response - The MPS is designated as the primary station for the data link and shall control the secondary station (RMS) on the data link. The MPS polls the RMS for information using one of the following formats.

4.3.1 Continuous Poll - The S frame structure for the Continuous Poll is shown below:

Bit Sequence	Function	Interpretation
'01111110'	Flag	Start Frame
'1'xxxxxxx	Link Address (RMS Address)	
'10001'N(R)	Control Field	RR frame with P = 1
FCS(1st Byte)	Frame Check Sequence	
FCS(2nd Byte)	Frame Check Sequence	
'01111110'	Flag	End Frame

4.3.2 Scheduled and Specific Polls - The I frame structure for the scheduled and specific polls is shown below:

Bit Sequence	Function	Interpretation
'01111110'	Flag	Start Frame
'1'xxxxxxx	Link Address (RMS Address)	
'0'N(S)'1'N(R)	Control Field	I frame with P = 1
'11111111'	Global Logical Unit	Scheduled Poll
or		or
xxxxxxxx	Logical Unit	Specific Poll LU Address
'00000000'	Delimiter	
'00000010'	Poll Indicator	Poll Message Function
FCS(1ST Byte)	Frame Check Sequence	
FCS(2nd Byte)	Frame Check Sequence	
'01111110'	Flag	

4.3.3 Scheduled and Specific Poll Response Priority - Messages waiting in the message buffer have transmission priority over scheduled and specific poll responses. If messages are waiting in the message buffer upon receipt of a poll, they shall be sent prior to the poll response. If a message is generated during a scheduled or specific poll response, the message shall be transmitted during the response, after the logical unit under transmission completes.

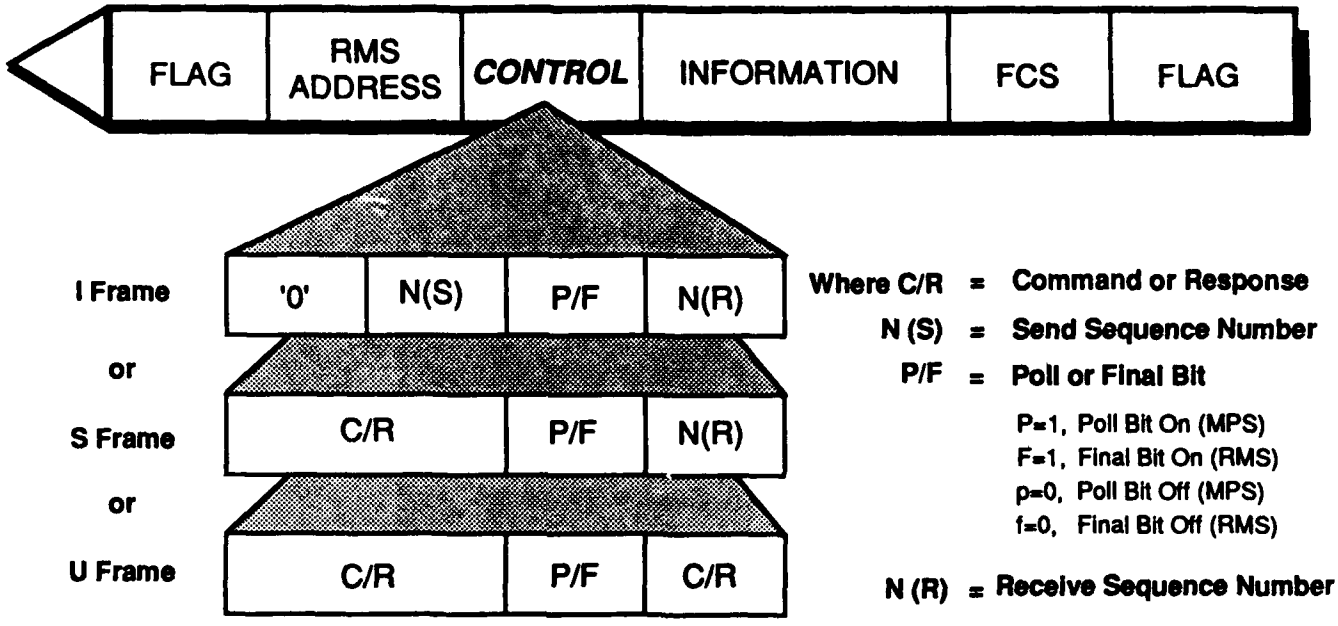
4.3.4 Message Transfer Examples - If the RMS has a message to send when polled, it shall send the message using I format. Intermediate frames shall have the final (f) bit set to '0' and the last frame shall have the final (F) bit set to '1'. The command and response procedures to transfer messages to the RMS shall be as shown in Figures 4.4 and 4.5 using the I frame. If the RMS detects an error during the reception of the I frame which is not recoverable by retransmission of the I frame, it shall send an Unnumbered Frame Reject (FRMR) response. On receipt of the FRMR response, the MPS shall declare a system error and send a Set Normal Response Mode (SNRM) command. If the RMS receives the frame without error, it shall respond with one of the following and in each case the N(R) shall indicate acceptance or rejection of the received frame.

(a) RR Response. When there is no priority message pending, an RR response shall be transmitted. On receipt of this response the MPS may proceed sending an additional frame or initiating another command procedure. If the message text is invalid because of format or content, the RMS shall reblock the text (Command Error Message) into an I frame.

(b) RNR Response. When there is no priority message pending and the RMS is temporarily not ready to receive or continue to receive I frames due to link level delays, it shall send a Receive Not Ready (RNR) response.

(c) DM Response. If the RMS was previously disconnected, a DM response shall be returned.

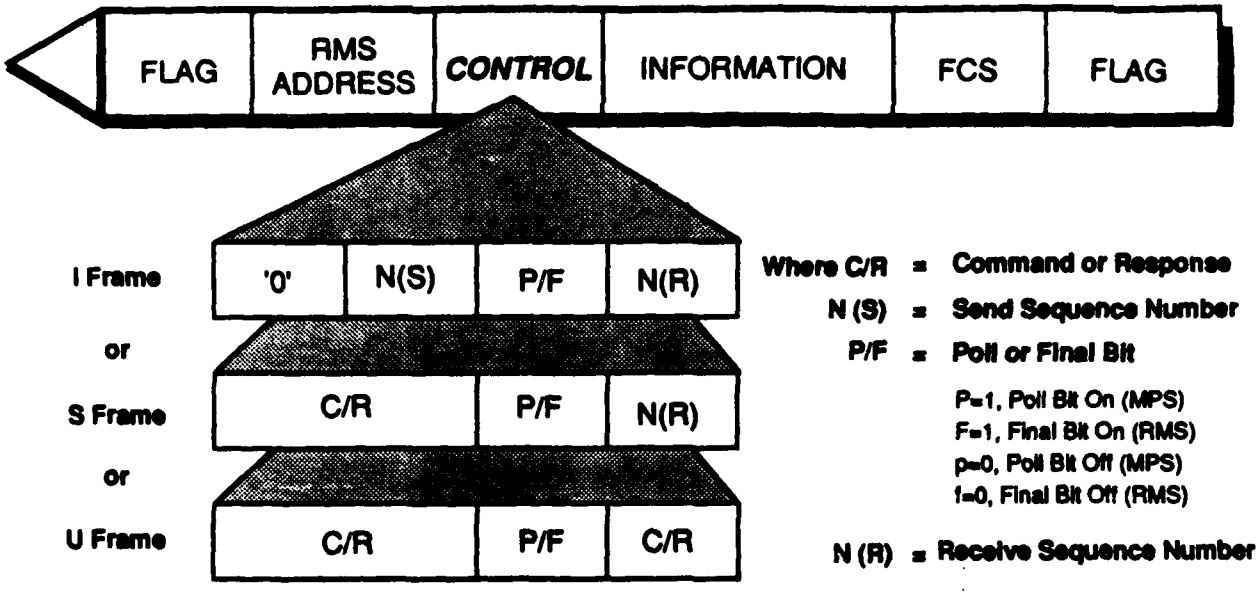
FIGURE 4.4 Example of On-Line and Off-Line Exchange



Frame Type	C/R	N(S)	P/F	N(R)		
U	SNRM	X	P	X	→	MPS places the addressed RMS in NRM. N(R) and N(S) counts are reset to 0
U	UA	X	F	X	←	RMS acknowledges with a UA response
U	DISC	X	P	X	→	MPS sets RMS off-line
U	UA	X	F	X	←	RMS acknowledges with a UA response
S	RR	X	P	000	→	MPS polls RMS
U	DM	X	F	X	←	RMS indicates it is disconnected with a DM response
I	X	000	P	000	→	MPS starts sending numbered I frames
I	X	001	P	000	→	
I	X	010	P	000	→	MPS sends poll I frame
U	DM	X	F	X	←	RMS denies receipt with a DM response
U	SNRM	X	P	X	→	MPS set RMS on-line. N(R) and N(S) counts reset to 0
U	UA	X	F	X	←	RMS acknowledges

Note: "X" indicates where field is not used.

FIGURE 4.5 Example of MPS and RMS Exchanging Numbered I Frames



Frame Type	C/R	N(S)	P/F	N(R)		
S	RR	X	P	000	→	MPS polls RMS
S	RR	X	F	000	←	RMS has nothing to transmit
S	RR	X	P	000	→	MPS polls RMS
I	I	000	F	000	←	RMS sends final I frame (frame 0)
S	RR	X	P	001	→	MPS confirms frame 0 and polls for transmission.
I	X	001	f	000	←	RMS sends 4 numbered I frames
I	X	010	f	000	←	
I	X	011	f	000	←	
I	X	100	F	000	←	RMS sends final I frame
I	X	000	p	101	→	MPS confirms frames 1-4 and starts sending I frames 0-2
I	X	001	p	101	→	
I	X	010	P	101	→	
I	X	101	f	011	←	RMS confirms frames 0-2 and starts sending I frames
I	X	110	f	011	←	
I	X	111	F	011	←	
I	X	011	p	000	→	MPS confirms frames 5-7 and continues sending I frames 3-5
I	X	100	p	000	→	
I	X	101	P	000	→	
S	RR	X	F	110	←	RMS confirms frames 3-5

Note: "X" indicates where field is not used.

4.4 Recovery Procedures - The general definition and framework of the recovery procedures shall be as specified in paragraph 8 of ANSI X3.66.

4.4.1 Timers - Timers are used to indicate when recognition of a specific response does not occur within specific periods. The following timers shall be used.

4.4.1.1 Frame Response Timer (A) - The primary station shall maintain a frame response timer to protect against an invalid or no response situation. The timer shall start after the transmission of a frame from the primary station with the P bit equal to '1' (P=1). The timer shall be stopped on receipt of a valid frame with the F bit equal to '1' (F=1).

4.4.1.2 RNR Timer (B) - This timer shall start as soon as the primary station receives an RNR response to an I frame. When this timer times out, it shall retransmit any unacknowledged messages.

4.4.2 Counters - Counters are used in recovery procedures to indicate how often consecutive communications attempts have failed. The following counters shall be used:

4.4.2.1 No Response Retry Counter (K1) - This counter is used by the primary station (the MPS) to detect when the maximum number of retransmission attempts (K1 max) resulting in invalid (frame rejects) or no responses has been reached. This counter shall be incremented by one after the primary station detects an invalid discarded frame or no response and reset on receipt of a valid response.

4.4.2.2 Completed Frame Counter (K2) - This counter is used by a receiving station (the RMS) to protect against non-recognition of the end of frame flag. This counter shall be reset on receipt of a start frame flag and incremented as each byte is received. If this counter exceeds the maximum number of counts (K2 max), the received frame shall be discarded. For the MLS RMS, K2 max shall equal 520.

4.4.2.3 Frame Retransmission Counter (K3) - This counter is used by the primary station (the MPS) to detect when the maximum number of retransmission attempts (K3 max) resulting in sequence number of FCS discrepancies has been reached. This counter shall be incremented by one after the primary station scans receives a REJ command/response and reset on receipt of a valid response.

4.4.2.4 Receive Not Ready Counter (K4) - This counter shall be used by the primary station (the MPS) receiving the Receive Not Ready (RNR) responses to detect when the maximum number of RNR's (K4 max) has been received. This counter shall be incremented by one each time an RNR is received. The counter shall be cleared on the receipt of an RR, reject or UA frame with or without the F bit equal to 1, or on receipt of an I frame with the F bit equal to 1.

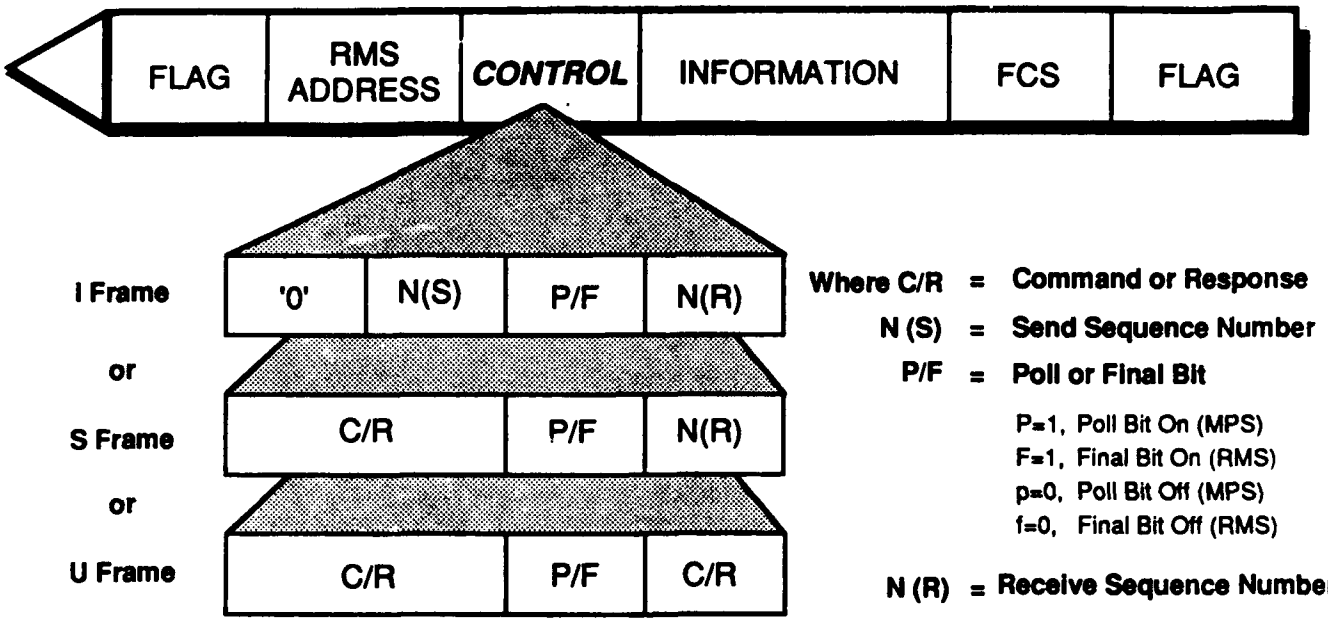
4.4.3 Retry Procedures

4.4 3.1 Retry Procedure 1 - No Response - If the MPS's timer A times out after transmitting a frame with the P bit set to 1 (requesting frame), it shall increment the no response counter (K1) by one and retransmit the unacknowledged frame(s). If the requesting frame is an I frame, the MPS may transmit an RR frame with the P bit set to one, prior to attempting the retransmission of any unacknowledged I frame(s). A separate counter shall be maintained for RR frames. This counter shall be incremented by one if the MPS's timer A times out due to an RR requesting frame and shall be reset when a valid response is received. If either counter reaches the maximum number of retries (K1 max) and a valid response has not been received, the MPS will declare the RMS nonresponsive and send a Disconnect (DISC) and/or a Set Normal Response (SNRM) command to reestablish communications.

4.4.3.2 Retry Procedure 2 - Sequence Error - When the MPS or RMS receives an unexpected sequence number, the receiving station shall use a rejecting response for retransmission requests starting with the I frame designated by N(R). In the event the receiving station, due to a transmission error, does not receive (or receives and discards due to an FCS error) a single I frame or the last I frame(s) in a sequence of I frames, it will not detect an out-of-sequence exception and, therefore, shall not initiate a rejecting response. If the MPS transmitted the unacknowledged I frame(s), it shall determine the sequence number at which retransmission must begin. The RMS need only check N(R) to determine if its last I frame was received. The Frame Retransmission Counter (K3) will be incremented by the MPS after each incorrect frame exchange. If the same condition occurs and the maximum number of retries (K3 max) has been reached, the MPS will declare an error and send a Disconnect (DISC) and a Set Normal Response Mode (SNRM) command to reestablish communications. Figure 4.6 illustrates this procedure.

4.4.3.3 Retry Procedure 3 - Busy Condition - At the first occurrence of an RNR response to an I frame from the secondary station, the primary station shall start an RNR timer (timer B) and retransmit the unacknowledged message(s) or a supervisory message when the RNR timer times out. With the continued existence of a busy condition, the busy condition must be reported by a retransmission of an RNR response with each P/F frame exchange. The primary station shall, on receipt of an RNR response, increment the RNR counter (K4) by one, reset the RNR timer (timer B), and repeat the above process. If the same condition occurs and the maximum number of retries (K4 max) has been reached, the primary station shall declare the RMS as nonresponsive and may send a disconnect and/or SNRM command to reestablish communications. Figure 4.7 illustrates this procedure.

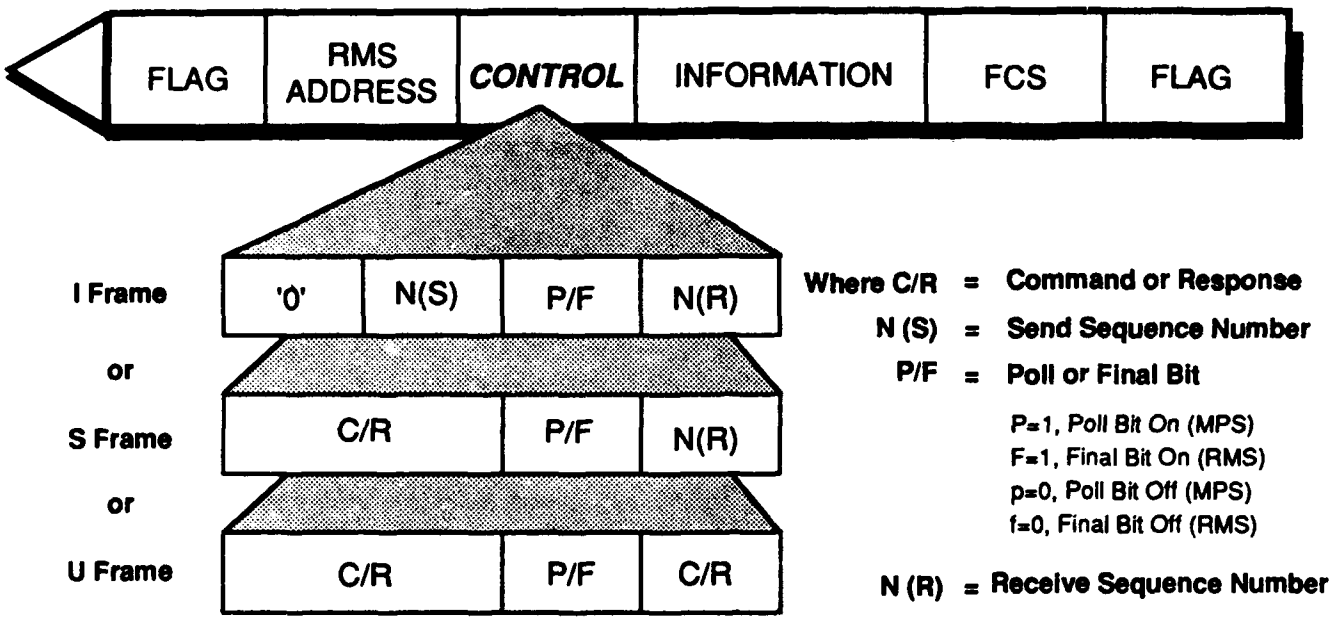
FIGURE 4.6 Retry Procedure 2



FRAME TYPE	C/R	N(S)	P/F	N(R)		
S	RR	X	P	000	→	MPS polls RMS
I	X	000	f	000	←	RMS sends numbered I frame
I	X	001	f	000	←	(I frame 2 has an FCS error)
I	X	010	f	000	←	
I	X	011	f	000	←	
I	X	100	F	000	←	RMS sends final I frame
S	REJ	X	P	010	→	MPS confirms frames 0 and 1
I	X	010	f	000	←	RMS resends frames 2-4
I	X	011	f	000	←	
I	X	100	F	000	←	RMS sends final I frame
S	RR	X	P	101	→	MPS confirms frames 2-4

Note: "X" indicates where field is not used.

FIGURE 4.7 Retry Procedure 3



Frame Type	C/R	N(S)	P/F	N(R)	
I	X	000	p	000	→ MPS starts sending numbered I frames
I	X	001	p	000	→
I	X	010	P	000	→ MPS sends final I frame
S	RNR	X	F	001	← RMS accepts frame 0 but cannot accept additional I frames
		. . .			
S	RR	X	P	000	→ MPS polls RMS
S	X	000	F	001	← One receipt of a poll, the RMS reports the end of the station busy condition

Note: "X" indicates where field is not used.

APPENDIX A MLS LOGICAL UNIT ADDRESSING

Appendix A - MLS Logical Unit Addressing

Definitions

The following logical units contain the MLS data that is available from the RMS. Each of the tables contains five columns of information. These tables shall serve as examples for Interface Control Documentation; all parameters defined in these Appendices shall be incorporated and all spare data points used shall be defined as follows:

ID: This is the hexadecimal address of one data item or parameter within the logical unit and is referred to as a Data Point. The data point in conjunction with the Logical Unit address gives each RMS data item a unique address. Parameter ID values shall be implemented as defined in the tables.

DESCRIPTION: This is a description of the parameter data that is encoded. This information is not stored or transmitted by the RMS in any form; it may be used by the MPS to describe the parameter values transmitted from the RMS.

VALUE: This field is a 16 bit binary number transmitted to represent a parameter numerical value or up to two ASCII characters. Numerical data is transmitted as an integer in the range -32768 to +32767 and the 'SCALE' value indicates the number of times to shift the decimal point to the left. A numeric data point value can be any value within the range described, although it is only necessary to use part of the range for realistic values. A range of numbers given in the 'VALUE' column represents a 'reasonableness' range with negative numbers given in parentheses, such as (-100)-100. An equal (=) sign in the value field indicates the data point is a condition and gives the only valid values for that data point. When characters are transmitted the 16 bit field provides for two ASCII characters. If only one character is needed, the remaining most significant byte shall contain '20H', the ASCII code for space (' ').

UNITS: This information is used by the MPS to identify the measurement units of numeric data, or to define the nature of condition data, such as Alarm or Normal. This information is not stored or transmitted by the RMS.

SCALE: This information is used at the MPS to convert the 16 bit number encoded in the value column into the actual parameter value. The numeric value of 'SCALE' indicates the number of decimal points for the integer 'VALUE' to be shifted. A '0' for 'SCALE' indicates that the numeric data is an integer and does not require a decimal point shift. When 'ASCII' is given for 'SCALE' this indicates that the value field contains two ASCII characters and decimal point shifting does not apply.

CONDITION STATUS — This field contains the current condition status code for each data point. In general, those data points that are variable will use the appropriate condition status codes from Table 3.1 (designated by 'T. 3.1') and constants and condition data points use condition status codes of 'A' (normal) or 'C' (alarm). A code of 'B' shall be used when any parameter is not currently monitored (such as offline equipment parameters), indicating the parameter value field is not applicable. Values given in the Appendices are provided as guidelines.

Examples

Example 1

Logical unit #24, data point 20H (see Appendix A.5) contains the value of the Azimuth as a mean angle error. On receipt of a numeric value in the expected range of -30 to +30 (although it is possible to send -32768 to +32767) as 'SCALE' equals 2 the decimal point will be shifted 2 places to the left allowing the parameter value of -0.30 to +0.30 to be decoded.

Example 2

For logical unit #2D, data point 22H (see Appendix A.11), the information provided is an ASCII character in the range A-Z. This indicates that for this data point the two byte value field will contain one character in the least significant byte followed by an ASCII space (20H) in the most significant byte and always contain an 'A' in the condition status field.

List of Allocated MLS RMS Logical Units

LU# (Hex)	Title
20	RMS Master
21	Terminal
22	Environmental Parameters
23	Not Used For MLS
24	Integrity and Secondary Parameters
25	Maintenance Parameters
26	Maintenance Parameters (DME/P)
27	Integrity and Secondary Thresholds
28	Maintenance Thresholds (Az)
29	Maintenance Thresholds (El)
2A	Maintenance Thresholds (DME/P)
2B	Environmental Thresholds
2C	Diagnostics results
2D	Basic Data Words
2E	Auxiliary Data Words
2F	Reserved For Future Use (up to 30 Auxiliary Data Words)
	Record of Events
30	Record of Events(1) (Integrity Alarms and Secondary Alerts)
31	Record of Events(2) (Maintenance Warnings)
32	Record of Events(3) (State Changes)
33	Record of Events(4) (Diagnostics Results)
	Historical Performance Records
40	Historical Perf. Record Timestamps
41	Integrity and Secondary Parameters(1)
42	Maintenance Parameters(1)
43	
44	Environmental Parameters(1)
45	RMS Master State Changes(1)
46	Terminal State Changes(1)
47	Integrity and Secondary Parameters(2)
48	Maintenance Parameters(2)
49	
4A	Environmental Parameters(2)
4B	RMS Master State Changes(2)
4C	Terminal State Changes(2)
4D	Integrity and Secondary Parameters(3)
4E	Maintenance Parameters(3)
4F	
50	Environmental Parameters(3)
51	RMS Master State Changes(3)
52	Terminal State Changes(3)

List of Allocated MLS RMS Logical Units (cont'd)

53	Integrity and Secondary Parameters(4)
54	Maintenance Parameters(4)
55	
56	Environmental Parameters(4)
57	RMS Master State Changes(4)
58	Terminal State Changes(4)
59	Integrity and Secondary Parameters(5)
5A	Maintenance Parameters(5)
5B	
5C	Environmental Parameters(5)
5D	RMS Master State Changes(5)
5E	Terminal State Changes(5)
5F	Integrity and Secondary Parameters(6)
60	Maintenance Parameters(6)
61	
62	Environmental Parameters(6)
63	RMS Master State Changes(6)
64	Terminal State Changes(6)
65	Integrity and Secondary Parameters(7)
66	Maintenance Parameters(7)
67	
68	Environmental Parameters(7)
69	RMS Master State Changes(7)
6A	Terminal State Changes(7)
6B	Integrity and Secondary Parameters(8)
6C	Maintenance Parameters(8)
6D	
6E	Environmental Parameters(8)
6F	RMS Master State Changes(8)
70	Terminal State Changes(8)
80	Equipment Control

A.1 RMS Master LU#20

ID	DESCRIPTION	VALUE		UNITS	SCALE	CONDIT STATUS
	Azimuth Equipment 1					
20	Configuration	1	=	Approach	0	A
		2	=	Back	0	A
21	Control	1	=	Operational	0	A
		2	=	Maintenance	0	A
		3	=	Not Available	0	A
22	Monitor	1	=	Normal	0	A
		2	=	Bypass	0	A
23	Transmitter A Designation	1	=	Primary	0	A
		2	=	Secondary	0	A
24	Transmitter A Status	1	=	On	0	A
		2	=	Off	0	A
		3	=	Alarm	0	C
25	Transmitter B Designation	1	=	Primary	0	A
		2	=	Secondary	0	A
26	Transmitter B Status	1	=	On	0	A
		2	=	Off	0	A
		3	=	Alarm	0	C
		4	=	Not Provided	0	A
	Azimuth Equipment 2					
27	Configuration	1	=	Approach	0	A
		2	=	Back	0	A
28	Control	1	=	Operational	0	A
		2	=	Maintenance	0	A
		3	=	Not Available	0	A
29	Monitor	1	=	Normal	0	A
		2	=	Bypass	0	A
2A	Transmitter A Designation	1	=	Primary	0	A
		2	=	Secondary	0	A
2B	Transmitter A Status	1	=	On	0	A
		2	=	Off	0	A
		3	=	Alarm	0	C
2C	Transmitter B Designation	1	=	Primary	0	A
		2	=	Secondary	0	A
2D	Transmitter B Status	1	=	On	0	A
		2	=	Off	0	A
		3	=	Alarm	0	C
		4	=	Not Provided	0	A

ID	DESCRIPTION	VALUE		UNITS	SCALE	CONDIT STATUS
	Elevation Equipment 1					
2E	Control	1	=	Operational	0	A
		2	=	Maintenance	0	A
		3	=	Not Available	0	A
2F	Monitor	1	=	Normal	0	A
		2	=	Bypass	0	A
30	Transmitter A Designation	1	=	Primary	0	A
		2	=	Secondary	0	A
31	Transmitter A Status	1	=	On	0	A
		2	=	Off	0	A
		3	=	Alarm	0	C
32	Transmitter B Designation	1	=	Primary	0	A
		2	=	Secondary	0	A
33	Transmitter B Status	1	=	On	0	A
		2	=	Off	0	A
		3	=	Alarm	0	C
		4	=	Not Provided	0	A
	Elevation Equipment 2					
34	Control	1	=	Operational	0	A
		2	=	Maintenance	0	A
		3	=	Not Available	0	A
35	Monitor	1	=	Normal	0	A
		2	=	Bypass	0	A
36	Transmitter A Designation	1	=	A Radiating	0	A
		2	=	B Radiating	0	A
37	Transmitter A Status	1	=	On	0	A
		2	=	Off	0	A
		3	=	Alarm	0	C
38	Transmitter B Designation	1	=	Primary	0	A
		2	=	Secondary	0	A
39	Transmitter B Status	1	=	On	0	A
		2	=	Off	0	A
		3	=	Alarm	0	C
		4	=	Not Provided	0	A

A.1 RMS Master (cont'd) LU#20

ID	DESCRIPTION	VALUE		UNITS	SCALE	CONDIT STATUS
	DME/P 1					
3A	Control	1	=	Operational	0	A
		2	=	Maintenance	0	A
		3	=	Not Available	0	A
3B	Monitor	1	=	Normal	0	A
		2	=	Bypass	0	A
3C	Transmitter A Designation	1	=	A Radiating	0	A
		2	=	B Radiating	0	A
3D	Transmitter A Status	1	=	On	0	A
		2	=	Off	0	A
		3	=	Alarm	0	C
3E	Transmitter B Designation	1	=	Primary	0	A
		2	=	Secondary	0	A
3F	Transmitter B Status	1	=	On	0	A
		2	=	Off	0	A
		3	=	Alarm	0	C
		4	=	Not Provided	0	A
	DME/P 2					
40	Control	1	=	Operational	0	A
		2	=	Maintenance	0	A
		3	=	Not Available	0	A
41	Monitor	1	=	Normal	0	A
		2	=	Bypass	0	A
42	Transmitter A Designation	1	=	A Radiating	0	A
		2	=	B Radiating	0	A
43	Transmitter A Status	1	=	On	0	A
		2	=	Off	0	A
		3	=	Alarm	0	C
44	Transmitter B Designation	1	=	Primary	0	A
		2	=	Secondary	0	A
45	Transmitter B Status	1	=	On	0	A
		2	=	Off	0	A
		3	=	Alarm	0	C
		4	=	Not Provided	0	A

A.2 Terminal LU#21

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	Azimuth Equipment 1				
20	Portable Terminal	1 =	Connected	0	A
		2 =	Disconnected	0	A
		3 =	Disabled	0	C
	Azimuth Equipment 2				
21	Portable Terminal	1 =	Connected	0	A
		2 =	Disconnected	0	A
		3 =	Disabled	0	C
	Elevation Equipment 1				
22	Portable Terminal	1 =	Connected	0	A
		2 =	Disconnected	0	A
		3 =	Disabled	0	C
	Elevation Equipment 2				
23	Portable Terminal	1 =	Connected	0	A
		2 =	Disconnected	0	A
		3 =	Disabled	0	C
	DME/P Equipment 1				
24	Portable Terminal	1 =	Connected	0	A
		2 =	Disconnected	0	A
		3 =	Disabled	0	C
	DME/P Equipment 2				
25	Portable Terminal	1 =	Connected	0	A
		2 =	Disconnected	0	A
		3 =	Disabled	0	C
	REU				
26	Portable Terminal	1 =	Connected	0	A
		2 =	Disconnected	0	A
		3 =	Disabled	0	C

A.3 Environmental Parameters LU#22

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	Azimuth Equipment 1				
20	Smoke and Fire Detection	1 =	Alarm	0	C
		2 =	Normal	0	A
21	Intrusion Detection	1 =	Alarm (Door Open)	0	C
		2 =	Normal	0	A
22	Electrical Power Status	1 =	Alarm (Battery)	0	C
		2 =	Normal (Primary)	0	A
23	Battery Case Temperature	(-50)-70	Degrees C	0	T. 3.1
	Environmental Control Status				
24	Heater 1	1 =	Alarm (Failed)	0	C
	-to-	2 =	Normal	0	A
2D	Heater 10	1 =	Alarm (Failed)	0	C
		2 =	Normal	0	A
2E	Fan 1	1 =	Alarm (Failed)	0	C
	-to-	2 =	Normal	0	A
37	Fan 10	1 =	Alarm (Failed)	0	C
		2 =	Normal	0	A
38	Equipment Enclosure Temp	(-50)-70	Degrees C	0	T. 3.1
39	10 Spare	-	-	-	-
42		-	-	-	-
	Azimuth Equipment 2				
43	Smoke and Fire Detection	1 =	Alarm	0	C
		2 =	Normal	0	A
44	Intrusion Detection	1 =	Alarm (Door Open)	0	C
		2 =	Normal	0	A
45	Electrical Power Status	1 =	Alarm (Battery)	0	C
		2 =	Normal (Primary)	0	A
46	Battery Case Temperature	(-50)-70	Degrees C	0	T. 3.1
	Environmental Control Status				
47	Heater 1	1 =	Alarm (Failed)	0	C
	-to-	2 =	Normal	0	A
50	Heater 10	1 =	Alarm (Failed)	0	C
		2 =	Normal	0	A
51	Fan 1	1 =	Alarm (Failed)	0	C
	-to-	2 =	Normal	0	A
5A	Fan 10	1 =	Alarm (Failed)	0	C
		2 =	Normal	0	A
5B	Equipment Enclosure Temp	(-50)-70	Degrees C	0	T. 3.1
5C	10 Spare	-	-	-	-
65		-	-	-	-

A.3 Environmental Parameters (cont'd) LU#22

ID	DESCRIPTION	VALUE		UNITS	SCALE	CONDIT STATUS
	Elevation Equipment 1					
66	Smoke and Fire Detection	1	=	Alarm	0	C
		2	=	Normal	0	A
67	Intrusion Detection	1	=	Alarm (Door Open)	0	C
		2	=	Normal	0	A
68	Electrical Power Status	1	=	Alarm (Battery)	0	C
		2	=	Normal (Primary)	0	A
69	Battery Case Temperature	(-50)-70		Degrees C	0	T. 3.1
	Environmental Control Status					
6A	Heater 1	1	=	Alarm (Failed)	0	C
	-to-	2	=	Normal	0	A
73	Heater 10	1	=	Alarm (Failed)	0	C
		2	=	Normal	0	A
74	Fan 1	1	=	Alarm (Failed)	0	C
	-to-	2	=	Normal	0	A
7E	Fan 10	1	=	Alarm (Failed)	0	C
		2	=	Normal	0	A
7F	Equipment Enclosure Temp	(-50)-70		Degrees C	0	T. 3.1
80	10 Spare	-		-	-	-
89		-		-	-	-
	Elevation Equipment 2					
8A	Smoke and Fire Detection	1	=	Alarm	0	C
		2	=	Normal	0	A
8B	Intrusion Detection	1	=	Alarm (Door Open)	0	C
		2	=	Normal	0	A
8C	Electrical Power Status	1	=	Alarm (Battery)	0	C
		2	=	Normal (Primary)	0	A
8D	Battery Case Temperature	(-50)-70		Degrees C	0	T. 3.1
	Environmental Control Status					
8E	Heater 1	1	=	Alarm (Failed)	0	C
	-to-	2	=	Normal	0	A
97	Heater 10	1	=	Alarm (Failed)	0	C
		2	=	Normal	0	A
98	Fan 1	1	=	Alarm (Failed)	0	C
	-to-	2	=	Normal	0	A
A1	Fan 10	1	=	Alarm (Failed)	0	C
		2	=	Normal	0	A
A2	Equipment Enclosure Temp	(-50)-70		Degrees C	0	T. 3.1
A3	10 Spare	-		-	-	-
AC		-		-	-	-

A.3 Environmental Parameters (cont'd) LU#22

ID	DESCRIPTION	VALUE		UNITS	SCALE	CONDIT STATUS
	DME/P Equipment 1					
AD	Smoke and Fire Detection	1	=	Alarm	0	C
		2	=	Normal	0	A
AE	Intrusion Detection	1	=	Alarm (Door Open)	0	C
		2	=	Normal	0	A
AF	Electrical Power Status	1	=	Alarm (Battery)	0	C
		2	=	Normal (Primary)	0	A
B0	Battery Case Temperature	(-50)-70		Degrees C	0	T. 3.1
	Environmental Control Status					
B1	Heater 1	1	=	Alarm (Failed)	0	C
	-to-	2	=	Normal	0	A
BA	Heater 10	1	=	Alarm (Failed)	0	C
		2	=	Normal	0	A
BB	Fan 1	1	=	Alarm (Failed)	0	C
	-to-	2	=	Normal	0	A
C4	Fan 10	1	=	Alarm (Failed)	0	C
		2	=	Normal	0	A
C5	Equipment Enclosure Temp	(-50)-70		Degrees C	0	T. 3.1
C6	10 Spare	-		-	-	-
CF		-		-	-	-
	DME/P Equipment 2					
D0	Smoke and Fire Detection	1	=	Alarm	0	C
		2	=	Normal	0	A
D1	Intrusion Detection	1	=	Alarm (Door Open)	0	C
		2	=	Normal	0	A
D2	Electrical Power Status	1	=	Alarm (Battery)	0	C
		2	=	Normal (Primary)	0	A
D3	Battery Case Temperature	(-50)-70		Degrees C	0	T. 3.1
	Environmental Control Status					
D4	Heater 1	1	=	Alarm (Failed)	0	C
	-to-	2	=	Normal	0	A
DD	Heater 10	1	=	Alarm (Failed)	0	C
		2	=	Normal	0	A
DE	Fan 1	1	=	Alarm (Failed)	0	C
	-to-	2	=	Normal	0	A
E8	Fan 10	1	=	Alarm (Failed)	0	C
		2	=	Normal	0	A
E9	Equipment Enclosure Temp	(-50)-70		Degrees C	0	T. 3.1
EA	10 Spare	-		-	-	-
F3		-		-	-	-

A.4 Communications LU#23

This logical unit address is reserved for telecommunications data points and is not used for MLS RMS.

A.5 Integrity and Secondary Parameters LU#24

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	Azimuth Equipment 1				
20	Mean Angle Error (Integral Monitor)	(-30)-30	Degrees	2	T. 3.1
21	Mean Angle Error (Field Monitor)	(-30)-30	Degrees	2	T. 3.1
22	Preamble ERP	(-100)-0	dB	1	T. 3.1
23	Scanning Beam ERP	(-100)-0	dB	1	T. 3.1
24	OCI ERP	(-100)-0	dB	1	T. 3.1
25	Peak Dynamic Sidelobe ERP	(-100)-0	dB	1	T. 3.1
26	Preamble Codes	1 =	Alarm	0	C
		2 =	Normal	0	A
27	Basic Data	1 =	Alarm	0	C
		2 =	Normal	0	A
28	Essential Auxiliary Data	1 =	Alarm	0	C
		2 =	Normal	0	A
29	TDM Sequence Synchronization	1 =	Alarm	0	C
		2 =	Normal	0	A
2A	Erroneous Signals Between Functions	1 =	Alarm	0	C
		2 =	Normal	0	A
2B	Non-Essential Auxiliary Data	1 =	Alarm	0	C
		2 =	Normal	0	A
2C	Monitor Verification Status	1 =	Alarm	0	C
		2 =	Normal	0	A
2D	End-to-End Integrity Check Status	1 =	Alarm	0	C
		2 =	Normal	0	A
2E	10 Spare	-	-	-	-
37		-	-	-	-
	Azimuth Equipment 2				
38	Mean Angle Error (Integral Monitor)	(-30)-30	Degrees	2	T. 3.1
39	Mean Angle Error (Field Monitor)	(-30)-30	Degrees	2	T. 3.1
3A	Preamble ERP	(-100)-0	dB	1	T. 3.1
3B	Scanning Beam ERP	(-100)-0	dB	1	T. 3.1
3C	OCI ERP	(-100)-0	dB	1	T. 3.1
3D	Peak Dynamic Sidelobe ERP	(-100)-0	dB	1	T. 3.1
3E	Preamble Codes	1 =	Alarm	0	C
		2 =	Normal	0	A
3F	Basic Data	1 =	Alarm	0	C
		2 =	Normal	0	A
40	Essential Auxiliary Data	1 =	Alarm	0	C
		2 =	Normal	0	A
41	TDM Sequence Synchronization	1 =	Alarm	0	C
		2 =	Normal	0	A
42	Erroneous Signals Between Functions	1 =	Alarm	0	C
		2 =	Normal	0	A
43	Non-Essential Auxiliary Data	1 =	Alarm	0	C
		2 =	Normal	0	A

A.5 Integrity and Secondary Parameters (cont'd) LU#24

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	Azimuth Equipment 2 (cont'd)				
44	Monitor Verification Status	1 =	Alarm	0	C
		2 =	Normal	0	A
45	End-to-End Integrity Check Status	1 =	Alarm	0	C
		2 =	Normal	0	A
46	10 Spare	-	-	-	-
4F		-	-	-	-
	Elevation Equipment 1				
50	Mean Angle Error (Integral Monitor)	(-30)-30	Degrees	2	T. 3.1
51	Mean Angle Error (Field Monitor)	(-30)-30	Degrees	2	T. 3.1
52	Preamble ERP	(-100)-0	dB	1	T. 3.1
53	Scanning Beam ERP	(-100)-0	dB	1	T. 3.1
54	OCI ERP	(-100)-0	dB	1	T. 3.1
55	Peak Dynamic Sidelobe ERP	(-100)-0	dB	1	T. 3.1
56	Preamble Codes	1 =	Alarm	0	C
		2 =	Normal	0	A
57	Monitor Verification Status	1 =	Alarm	0	C
		2 =	Normal	0	A
58	End-to-End Integrity Check Status	1 =	Alarm	0	C
		2 =	Normal	0	A
59	10 Spare	-	-	-	-
62		-	-	-	-
	Elevation Equipment 2				
63	Mean Angle Error (Integral Monitor)	(-30)-30	Degrees	2	T. 3.1
64	Mean Angle Error (Field Monitor)	(-30)-30	Degrees	2	T. 3.1
65	Preamble ERP	(-100)-0	dB	1	T. 3.1
66	Scanning Beam ERP	(-100)-0	dB	1	T. 3.1
67	OCI ERP	(-100)-0	dB	1	T. 3.1
68	Peak Dynamic Sidelobe ERP	(-100)-0	dB	1	T. 3.1
69	Preamble Codes	1 =	Alarm	0	C
		2 =	Normal	0	A
6A	Monitor Verification Status	1 =	Alarm	0	C
		2 =	Normal	0	A
6B	End-to-End Integrity Check Status	1 =	Alarm	0	C
		2 =	Normal	0	A
6C	10 Spare	-	-	-	-
75		-	-	-	-

A.5 Integrity and Secondary Parameters (cont'd) LDI#24

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	DME/P Equipment 1				
76	Reply Delay PFE (IA Mode)	(-100)-100	uS	2	T. 3.1
77	Reply Delay PFE (FA Mode)	(-100)-100	uS	3	T. 3.1
78	Reply ERP	(-100)-0	dB	1	T. 3.1
79	Reply Efficiency (FA Mode)	0-100	%	0	T. 3.1
7A	Reply Pulse Code Error	(-700)-700	uS	1	T. 3.1
7B	Monitor Verification Status	1 =	Alarm	0	C
		2 =	Normal	0	A
7C	End-to-End Integrity Check Status	1 =	Alarm	0	C
		2 =	Normal	0	A
7D	10 Spare	-	-	-	-
86		-	-	-	-
	DME/P Equipment 2				
87	Reply Delay PFE (IA Mode)	(-100)-100	uS	2	T. 3.1
88	Reply Delay PFE (FA Mode)	(-100)-100	uS	3	T. 3.1
89	Reply ERP	(-100)-0	dB	1	T. 3.1
8A	Reply Efficiency (FA Mode)	0-100	%	0	T. 3.1
8B	Reply Pulse Code Error	(-700)-700	uS	1	T. 3.1
8C	Monitor Verification Status	1 =	Alarm	0	C
		2 =	Normal	0	A
8D	End-to-End Integrity Check Status	1 =	Alarm	0	C
		2 =	Normal	0	A
8E	10 Spare	-	-	-	-
97		-	-	-	-

A.6 Maintenance Parameters LU#25

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	Azimuth Equipment 1				
20	Mean Angle Error (Integral Monitor)	(-30)-30	Degrees	2	T. 3.1
21	Mean Angle Error (Field Monitor)	(-30)-30	Degrees	2	T. 3.1
22	Angle CMN	(-30)-30	Degrees	2	T. 3.1
23	Preamble ERP	(-100)-0	dB	1	T. 3.1
24	Scanning Beam ERP	(-100)-0	dB	1	T. 3.1
25	OCI ERP	(-100)-0	dB	1	T. 3.1
26	Peak Dynamic Sidelobe ERP	(-100)-0	dB	1	T. 3.1
27	Exciter Power Output	0-500	mW	1	T. 3.1
28	Transmitter Power Output	0-300	Watts	1	T. 3.1
29	Synthesizer Frequency Lock	(-250)-250	kHz	1	T. 3.1
2A	Secondary Transmitter Status	1 =	Normal	0	A
		2 =	Alarm	0	C
		3 =	Not Provided	0	A
2B	20 Spare	-	-	-	-
4E		-	-	-	-
4F	Azimuth Up-Date Rate	0-500	Hz	1	T. 3.1
50	Basic Data 1 Up-Date Rate	0-100	Hz	1	T. 3.1
51	Basic Data 2 Up-Date Rate	0-100	Hz	1	T. 3.1
52	Basic Data 3 Up-Date Rate	0-100	Hz	1	T. 3.1
53	Basic Data 4 Up-Date Rate	0-100	Hz	1	T. 3.1
54	Basic Data 5 Up-Date Rate	0-100	Hz	1	T. 3.1
55	Basic Data 6 Up-Date Rate	0-100	Hz	1	T. 3.1
56	Auxiliary Data 1 Up-Date Rate	0-100	Hz	1	T. 3.1
57	Auxiliary Data 2 Up-Date Rate	0-100	Hz	1	T. 3.1
58	Auxiliary Data 3 Up-Date Rate	0-100	Hz	1	T. 3.1
59	Auxiliary Data 4 Up-Date Rate	0-100	Hz	1	T. 3.1
	Power Supply Voltages:				T. 3.1
5A	P.S.1	(-1500)-	Volts	1	T. 3.1
	-to-	1500			
63	P.S.10	(-1500)-1500	Volts	1	T. 3.1

A.6 Maintenance Parameters (cont'd) LU#25

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	Azimuth Equipment 2				
64	Mean Angle Error (Integral Monitor)	(-30)-30	Degrees	2	T. 3.1
65	Mean Angle Error (Field Monitor)	(-30)-30	Degrees	2	T. 3.1
66	Angle CMN	(-30)-30	Degrees	2	T. 3.1
67	Preamble ERP	(-100)-0	dB	1	T. 3.1
68	Scanning Beam ERP	(-100)-0	dB	1	T. 3.1
69	OCI ERP	(-100)-0	dB	1	T. 3.1
6A	Peak Dynamic Sidelobe ERP	(-100)-0	dB	1	T. 3.1
6B	Exciter Power Output	0-500	mW	1	T. 3.1
6C	Transmitter Power Output	0-300	Watts	1	T. 3.1
6D	Synthesizer Frequency Lock	(-250)-250	kHz	1	T. 3.1
6E	Secondary Transmitter Status	1 =	Normal	0	A
		2 =	Alarm	0	C
		3 =	Not Provided	0	A
6F	20 Spare	-	-	-	-
82		-	-	-	-
83	Azimuth Up-Date Rate	0-500	Hz	1	T. 3.1
84	Basic Data 1 Up-Date Rate	0-100	Hz	1	T. 3.1
85	Basic Data 2 Up-Date Rate	0-100	Hz	1	T. 3.1
86	Basic Data 3 Up-Date Rate	0-100	Hz	1	T. 3.1
87	Basic Data 4 Up-Date Rate	0-100	Hz	1	T. 3.1
88	Basic Data 5 Up-Date Rate	0-100	Hz	1	T. 3.1
89	Basic Data 6 Up-Date Rate	0-100	Hz	1	T. 3.1
8A	Auxiliary Data 1 Up-Date Rate	0-100	Hz	1	T. 3.1
8B	Auxiliary Data 2 Up-Date Rate	0-100	Hz	1	T. 3.1
8C	Auxiliary Data 3 Up-Date Rate	0-100	Hz	1	T. 3.1
8D	Auxiliary Data 4 Up-Date Rate	0-100	Hz	1	T. 3.1
	Power Supply Voltages:				T. 3.1
8E	P.S.1	(-1500)	Volts	1	T. 3.1
	-to-	1500			
97	P.S.10	(-1500)-1500	Volts	1	T. 3.1

A.6 Maintenance Parameters (cont'd) LU#25

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	Elevation Equipment 1				
98	Mean Angle Error (Integral Monitor)	(-30)-30	Degrees	2	T. 3.1
99	Mean Angle Error (Field Monitor)	(-30)-30	Degrees	2	T. 3.1
9A	Angle CMN	(-30)-30	Degrees	2	T. 3.1
9B	Preamble ERP	(-100)-0	dB	1	T. 3.1
9C	Scanning Beam ERP	(-100)-0	dB	1	T. 3.1
9F	OCI ERP	(-100)-0	dB	1	T. 3.1
A0	Peak Dynamic Sidelobe ERP	(-100)-0	dB	1	T. 3.1
A1	Exciter Power Output	0-500	mW	1	T. 3.1
A2	Transmitter Power Output	0-300	Watts	1	T. 3.1
A3	Synthesizer Frequency Lock	(-250)-250	kHz	1	T. 3.1
A4	Elevation Update Rate	0-500	Hz	1	T. 3.1
A5	Secondary Transmitter Status	1 =	Normal	0	A
		2 =	Alarm	0	C
		3 =	Not Provided	0	A
A6	20 Spare	-	-	-	-
B9		-	-	-	-
	Power Supply Voltages:				T. 3.1
BA	P.S.1	(-1500)-1500	Volts	1	T. 3.1
	-to-				
BB	P.S.10	(-1500) 1500	Volts	1	T. 3.1
	Elevation Equipment 2				
BC	Mean Angle Error (Integral Monitor)	(-30)-30	Degrees	2	T. 3.1
BD	Mean Angle Error (Field Monitor)	(-30)-30	Degrees	2	T. 3.1
BE	Angle CMN	(-30)-30	Degrees	2	T. 3.1
C0	Preamble ERP	(-100)-0	dB	1	T. 3.1
C1	Scanning Beam ERP	(-100)-0	dB	1	T. 3.1
C2	OCI ERP	(-100)-0	dB	1	T. 3.1
C3	Peak Dynamic Sidelobe ERP	(-100)-0	dB	1	T. 3.1
C4	Exciter Power Output	0-500	mW	1	T. 3.1
C5	Transmitter Power Output	0-300	Watts	1	T. 3.1
C6	Synthesizer Frequency Lock	(-250)-250	kHz	1	T. 3.1
C7	Elevation Update Rate	0-500	Hz	1	T. 3.1
C8	Secondary Transmitter Status	1 =	Normal	0	A
		2 =	Alarm	0	C
		3 =	Not Provided	0	A
C9	20 Spare	-	-	-	-
DC		-	-	-	-
	Power Supply Voltages:				T. 3.1
DD	P.S.1	(-1500)-1500	Volts	1	T. 3.1
	-to-				
E6	P.S.10	(-1500)-1500	Volts	1	T. 3.1

A.6 Maintenance Parameters (DME/P) LU#26

The DME/P maintenance parameters are located in a separate LU to allow unique numbering of data points (numbering would otherwise exceed FF).

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	DME/P Equipment 1				
20	Transmission Rate	0-6000	Pulse Pairs	0	T. 3.1
21	Interrogation Pulse Code Rejection	0-100	dB	1	T. 3.1
22	Reply Pulse Partial Rise Time	0-50	uS	2	T. 3.1
23	Reply Delay PFE (IA Mode)	(-100)-100	uS	2	T. 3.1
24	Reply Delay PFE (FA Mode)	(-100)-100	uS	3	T. 3.1
25	Reply Delay CMN (IA Mode)	(-10)-10	uS	2	T. 3.1
26	Reply Delay CMN (FA Mode)	(-10)-10	uS	2	T. 3.1
27	Reply ERP Transmitter Power	(-100)-100	dB	1	T. 3.1
28	Morse Code Identification	1 =	Alarm	0	C
		2 =	Normal	0	A
29	Reply Efficiency (IA Mode)	0-100	%	0	T. 3.1
2A	Reply Efficiency (FA Mode)	0-100	%	0	T. 3.1
2B	Synthesizer Frequency Lock	(-150)-150	kHz	1	T. 3.1
2C	FA Decode Rate	1 =	Alarm	0	C
		2 =	Normal	0	A
2D	Reply Pulse Code Error	(-700)-700	uS	1	T. 3.1
2E	Secondary Transmitter Status	1 =	Normal	0	A
		2 =	Alarm	0	C
		3 =	Not Provided	0	A
2F	20 Spare	-	-	-	-
42		-	-	-	-
	Power Supply Voltages:				
43	P.S.1	(-1500)-1500	Volts	1	
	-to-				
4C	P.S.10	(-1500)-1500	Volts	1	
	DME/P Equipment 2				
4D	Transmission Rate	0-6000	Pulse Pairs	0	T. 3.1
4E	Interrogation Pulse Code Rejection	0-100	dB	1	T. 3.1
4F	Reply Pulse Partial Rise Time	0-50	uS	2	T. 3.1
50	Reply Delay PFE (IA Mode)	(-100)-100	uS	2	T. 3.1
51	Reply Delay PFE (FA Mode)	(-100)-100	uS	3	T. 3.1
52	Reply Delay CMN (IA Mode)	(-10)-10	uS	2	T. 3.1
53	Reply Delay CMN (FA Mode)	(-10)-10	uS	2	T. 3.1
54	Reply ERP Transmitter Power	(-100)-100	dB	1	T. 3.1
55	Morse Code Identification	1 =	Alarm	0	C
		2 =	Normal	0	A
56	Reply Efficiency (IA Mode)	0-100	%	0	T. 3.1
57	Reply Efficiency (FA Mode)	0-100	%	0	T. 3.1
58	Synthesizer Frequency Lock	(-150)-150	kHz	1	T. 3.1
59	FA Decode Rate	1 =	Alarm	0	C
		2 =	Normal	0	A
5A	Reply Pulse Code Error	(-700)-700	uS	1	T. 3.1

A.6 Maintenance Parameters (DME/P, cont'd) LU#26

ID	DESCRIPTION	VALUE		UNITS	SCALE	CONDIT STATUS
	DME/P Equipment 2 (cont'd)					
5B	Secondary Transmitter Status	1	=	Normal	0	A
		2	=	Alarm	0	C
		3	=	Not Provided	0	A
5C	20 Spare	-		-	-	-
6F		-		-	-	-
	Power Supply Voltages:					
70	P.S.1	(-1500)-1500		Volts	1	
	-to-					
79	P.S.10	(-1500)-1500		Volts	1	

A.7 Integrity and Secondary Thresholds LU#27

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONFIT STATUS
	Azimuth Equipment 1				
	Mean Angle Error (MAE):				
20	MAE (Integral Monitor) Upper Limit	0-30	Degrees	2	A
21	MAE (Integral Monitor) Lower Limit	(-30)-0	Degrees	2	A
22	MAE (Field Monitor) Upper Limit	0-30	Degrees	2	A
23	MAE (Field Monitor) Lower Limit	(-30)-0	Degrees	2	A
24	Preamble ERP	(-100)-0	dB	1	A
25	Scanning Beam ERP	(-100)-0	dB	1	A
26	OCI ERP	(-100)-0	dB	1	A
27	Peak Dynamic Sidelobe ERP	(-100)-0	dB	1	A
28	10 Spare	-	-	-	-
31		-	-	-	-
	Azimuth Equipment 2				
	Mean Angle Error (MAE):				
32	MAE (Integral Monitor) Upper Limit	0-30	Degrees	2	A
33	MAE (Integral Monitor) Lower Limit	(-30)-0	Degrees	2	A
34	MAE (Field Monitor) Upper Limit	0-30	Degrees	2	A
35	MAE (Field Monitor) Lower Limit	(-30)-0	Degrees	2	A
36	Preamble ERP	(-100)-0	dB	1	A
37	Scanning Beam ERP	(-100)-0	dB	1	A
38	OCI ERP	(-100)-0	dB	1	A
39	Peak Dynamic Sidelobe ERP	(-100)-0	dB	1	A
3A	10 Spare	-	-	-	-
43		-	-	-	-
	Elevation Equipment 1				
	Mean Angle Error (MAE):				
44	MAE (Integral Monitor) Upper Limit	0-30	Degrees	2	A
45	MAE (Integral Monitor) Lower Limit	(-30)-0	Degrees	2	A
46	MAE (Field Monitor) Upper Limit	0-30	Degrees	2	A
47	MAE (Field Monitor) Lower Limit	(-30)-0	Degrees	2	A
48	Preamble ERP	(-100)-0	dB	1	A
49	Scanning Beam ERP	(-100)-0	dB	1	A
4A	OCI ERP	(-100)-0	dB	1	A
4B	Peak Dynamic Sidelobe ERP	(-100)-0	dB	1	A
4C	10 Spare	-	-	-	-
55		-	-	-	-

A.7 Integrity and Secondary Thresholds (cont'd) LU#27

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	Elevation Equipment 2				
	Mean Angle Error (MAE):				
56	MAE (Integral Monitor) Upper Limit	0-30	Degrees	2	A
57	MAE (Integral Monitor) Lower Limit	(-30)-0	Degrees	2	A
58	MAE (Field Monitor) Upper Limit	0-30	Degrees	2	A
59	MAE (Field Monitor) Lower Limit	(-30)-0	Degrees	2	A
5A	Preamble ERP	(-100)-0	dB	1	A
5B	Scanning Beam ERP	(-100)-0	dB	1	A
5C	OCI ERP	(-100)-0	dB	1	A
5D	Peak Dynamic Sidelobe ERP	(-100)-0	dB	1	A
5E	10 Spare	-	-	-	-
67		-	-	-	-
	DME/P Equipment 1				
68	Reply Delay PFE (IA Mode) Upper Lim	0-100	uS	2	A
69	Reply Delay PFE (IA Mode) Lower Lim	(-100)-0	uS	2	A
6A	Reply Delay PFE (FA Mode) Upper Lim	0-100	uS	3	A
6B	Reply Delay PFE (FA Mode) Lower Lim	(-100)-0	uS	3	A
6C	Reply ERP Upper Limit	0-100	dB	1	A
6D	Reply ERP Lower Limit	(-100)-0	dB	1	A
6E	Reply Efficiency (FA Mode)	0-100	%	0	A
6F	Reply Pulse Code Error Upper Limit	(-700)-700	uS	1	A
70	Reply Pulse Code Error Lower Limit	(-700)-700	uS	1	A
71	10 Spare	-	-	-	-
7A		-	-	-	-
	DME/P Equipment 2				
7B	Reply Delay PFE (IA Mode) Upper Lim	40-70	uS	2	A
7C	Reply Delay PFE (IA Mode) Lower Lim	40-70	uS	2	A
7D	Reply Delay PFE (FA Mode) Upper Lim	(-100)-100	uS	3	A
7E	Reply Delay PFE (FA Mode) Lower Lim	(-100)-100	uS	3	A
7F	Reply ERP Upper Limit	0-100	dB	1	A
80	Reply ERP Lower Limit	(-100)-0	dB	1	A
81	Reply Efficiency (FA Mode)	0-100	%	0	A
82	Reply Pulse Code Error Upper Limit	(-700)-700	uS	1	A
83	Reply Pulse Code Error Lower Limit	(-700)-700	uS	1	A
84	10 Spare	-	-	-	-
8D		-	-	-	-

A.8 Maintenance Thresholds (Az) LU#28

The Azimuth maintenance parameter thresholds are located in a separate LU to allow unique numbering of data points (numbering would otherwise exceed FF).

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	Azimuth Equipment 1				
	Mean Angle Error (MAE):				
20	MAE (Integral Monitor) Upper Limit	0-30	Degrees	2	A
21	MAE (Integral Monitor) Lower Limit	(-30)-0	Degrees	2	A
22	MAE (Field Monitor) Upper Limit	0-30	Degrees	2	A
23	MAE (Field Monitor) Lower Limit	(-30)-0	Degrees	2	A
24	Angle CMN Upper Limit	0-30	Degrees	2	A
25	Angle CMN Lower Limit	(-30)-0	Degrees	2	A
26	Preamble ERP	(-100)-0	dB	1	A
27	Scanning Beam ERP	(-100)-0	dB	1	A
28	OCI ERP	(-100)-0	dB	1	A
29	Peak Dynamic Sidelobe ERP	(-100)-0	dB	1	A
2A	Exciter Power Output	0-500	mW	1	A
2B	Transmitter Power Output	0-300	Watts	1	A
2C	Synthesizer Frequency Lock Upper Lim	0-250	kHz	1	A
2D	Synthesizer Frequency Lock Lower Lim	(-250)-0	kHz	1	A
2E	20 Spare	-	-	-	-
41		-	-	-	-
42	Azimuth Up-Date Rate	0-500	Hz	1	A
43	Basic Data 1 Up-Date Rate	0-100	Hz	1	A
44	Basic Data 2 Up-Date Rate	0-100	Hz	1	A
45	Basic Data 3 Up-Date Rate	0-100	Hz	1	A
46	Basic Data 4 Up-Date Rate	0-100	Hz	1	A
47	Basic Data 5 Up-Date Rate	0-100	Hz	1	A
48	Basic Data 6 Up-Date Rate	0-100	Hz	1	A
49	Auxiliary Data 1 Up-Date Rate	0-100	Hz	1	A
4A	Auxiliary Data 2 Up-Date Rate	0-100	Hz	1	A
4B	Auxiliary Data 3 Up-Date Rate	0-100	Hz	1	A
4C	Auxiliary Data 4 Up-Date Rate	0-100	Hz	1	A
	Power Supply Voltages:				
4D	P.S.1 Upper Limit	(-1500)-1500	Volts	1	A
4E	P.S.1 Lower Limit	(-1500)-1500	Volts	1	A
	-to-				
5F	P.S.10 Upper Limit	(-1500)-1500	Volts	1	A
60	P.S.10 Lower Limit	(-1500)-1500	Volts	1	A

A.8 Maintenance Thresholds (Az, cont'd) LU#28

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	Azimuth Equipment 2				
	Mean Angle Error (MAE):				
61	MAE (Integral Monitor) Upper Limit	0-30	Degrees	2	A
62	MAE (Integral Monitor) Lower Limit	(-30)-0	Degrees	2	A
63	MAE (Field Monitor) Upper Limit	0-30	Degrees	2	A
64	MAE (Field Monitor) Lower Limit	(-30)-0	Degrees	2	A
65	Angle CMN Upper Limit	0-30	Degrees	2	A
66	Angle CMN Lower Limit	(-30)-0	Degrees	2	A
67	Preamble ERP	(-100)-0	dB	1	A
68	Scanning Beam ERP	(-100)-0	dB	1	A
69	OCI ERP	(-100)-0	dB	1	A
6A	Peak Dynamic Sidelobe ERP	(-100)-0	dB	1	A
6B	Exciter Power Output	0-500	mW	1	A
6C	Transmitter Power Output	0-300	Watts	1	A
6D	Synthesizer Frequency Lock Upper Lim	0-250	kHz	1	A
6E	Synthesizer Frequency Lock Lower Lim	(-250)-0	kHz	1	A
6F	20 Spare	-	-	-	-
82		-	-	-	-
83	Azimuth Up-Date Rate	0-500	Hz	1	A
84	Basic Data 1 Up-Date Rate	0-100	Hz	1	A
85	Basic Data 2 Up-Date Rate	0-100	Hz	1	A
86	Basic Data 3 Up-Date Rate	0-100	Hz	1	A
87	Basic Data 4 Up-Date Rate	0-100	Hz	1	A
88	Basic Data 5 Up-Date Rate	0-100	Hz	1	A
89	Basic Data 6 Up-Date Rate	0-100	Hz	1	A
8A	Auxiliary Data 1 Up-Date Rate	0-100	Hz	1	A
8B	Auxiliary Data 2 Up-Date Rate	0-100	Hz	1	A
8C	Auxiliary Data 3 Up-Date Rate	0-100	Hz	1	A
8D	Auxiliary Data 4 Up-Date Rate	0-100	Hz	1	A
	Power Supply Voltages:				
8E	P.S.1 Upper Limit	(-1500)-1500	Volts	1	A
90	P.S.1 Lower Limit	(-1500)-1500	Volts	1	A
	-to-				
A0	P.S.10 Upper Limit	(-1500)-1500	Volts	1	A
A1	P.S.10 Lower Limit	(-1500)-1500	Volts	1	A

A.8 Maintenance Thresholds (E1) LU#29

The Elevation maintenance parameter thresholds are located in a separate LU to allow unique numbering of data points (numbering would otherwise exceed FF).

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	Elevation Equipment 1				
	Mean Angle Error (MAE):				
20	MAE (Integral Monitor) Upper Limit	0-30	Degrees	2	A
21	MAE (Integral Monitor) Lower Limit	(-30)-0	Degrees	2	A
22	MAE (Field Monitor) Upper Limit	0-30	Degrees	2	A
23	MAE (Field Monitor) Lower Limit	(-30)-0	Degrees	2	A
24	Angle CMN Upper Limit	0-30	Degrees	2	A
25	Angle CMN Lower Limit	(-30)-0	Degrees	2	A
26	Preamble ERP	(-100)-0	dB	1	A
27	Scanning Beam ERP	(-100)-0	dB	1	A
28	OCI ERP	(-100)-0	dB	1	A
29	Peak Dynamic Sidelobe ERP	(-100)-0	dB	1	A
2A	Exciter Power Output	0-500	mW	1	A
2B	Transmitter Power Output	0-300	Watts	1	A
2C	Synthesizer Frequency Lock Upper Lim	(-250)-250	kHz	1	A
2D	Synthesizer Frequency Lock Lower Lim	(-250)-250	kHz	1	A
2E	Elevation Update Rate	0-500	Hz	1	A
2F	20 Spare	-	-	-	-
42		-	-	-	-
	Power Supply Voltages:				
43	P.S.1 Upper Limit	(-1500)-1500	Volts	1	A
44	P.S.1 Lower Limit	(-1500)-1500	Volts	1	A
	-to-				
56	P.S.10 Upper Limit	(-1500)-1500	Volts	1	A
57	P.S.10 Lower Limit	(-1500)-1500	Volts	1	A

A.8 Maintenance Thresholds (El, cont'd) LU#29

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	Elevation Equipment 2				
	Mean Angle Error (MAE):				
58	MAE (Integral Monitor) Upper Limit	(-30)-30	Degrees	2	A
59	MAE (Integral Monitor) Lower Limit	(-30)-30	Degrees	2	A
5A	MAE (Field Monitor) Upper Limit	(-30)-30	Degrees	2	A
5B	MAE (Field Monitor) Lower Limit	(-30)-30	Degrees	2	A
5C	Angle CMN	(-30)-30	Degrees	2	A
5D	Angle CMN	(-30)-30	Degrees	2	A
5E	Preamble ERP	(-100)-0	dB	1	A
5F	Scanning Beam ERP	(-100)-0	dB	1	A
60	OCI ERP	(-100)-0	dB	1	A
61	Peak Dynamic Sidelobe ERP	(-100)-0	dB	1	A
62	Exciter Power Output	0-500	mW	1	A
63	Transmitter Power Output	0-300	Watts	1	A
64	Synthesizer Frequency Lock Upper Lim	(-250)-250	kHz	1	A
65	Synthesizer Frequency Lock Lower Lim	(-250)-250	kHz	1	A
66	Elevation Update Rate	0-500	Hz	1	A
67	20 Spare	-	-	-	-
7A		-	-	-	-
	Power Supply Voltages:				
7B	P.S.1 Upper Limit	(-1500)-1500	Volts	1	A
7C	P.S.1 Lower Limit	(-1500)-1500	Volts	1	A
	-to-				
8D	P.S.10 Upper Limit	(-1500)-1500	Volts	1	A
8E	P.S.10 Lower Limit	(-1500)-1500	Volts	1	A

A.8 Maintenance Thresholds (DME/P) LU#2A

The DME/P maintenance parameter thresholds are located in a separate LU to allow unique numbering of data points (numbering would otherwise exceed FF).

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	DME/P Equipment 1				
20	Transmission Rate	0-6000	Pulse Pairs	0	A
21	Interrogation Pulse Code Rejection	0-100	dB	1	A
22	Reply Pulse Partial Rise Time	0-50	uS	2	A
23	Reply Delay PFE (IA Mode) Upper Limit	0-100	uS	2	A
24	Reply Delay PFE (IA Mode) Lower Limit	(-100)-0	uS	2	A
25	Reply Delay PFE (FA Mode) Upper Limit	0-100	uS	3	A
26	Reply Delay PFE (FA Mode) Lower Limit	(-100)-0	uS	3	A
27	Reply Delay CMN (IA Mode) Upper Limit	0-10	uS	2	A
28	Reply Delay CMN (IA Mode) Lower Limit	(-10)-0	uS	2	A
29	Reply Delay CMN (FA Mode) Upper Limit	0-10	uS	2	A
2A	Reply Delay CMN (FA Mode) Lower Limit	(-10)-0	uS	2	A
2B	Reply ERP Transmitter Power Upper Lim	0-100	dB	1	A
2C	Reply ERP Transmitter Power Lower Lim	(-100)-0	dB	1	A
2D	Reply Efficiency (IA Mode)	0-100	%	0	A
2E	Reply Efficiency (FA Mode)	0-100	%	0	A
2F	Synthesizer Frequency Lock Upper Lim	(-250)-250	kHz	1	A
30	Synthesizer Frequency Lock Lower Lim	(-250)-250	kHz	1	A
31	Reply Pulse Code Error Upper Limit	(-500)-500	uS	3	A
32	Reply Pulse Code Error Lower Limit	(-500)-500	uS	3	A
33	20 Spare	-	-	-	-
46		-	-	-	-
	Power Supply Voltages:				
47	P.S.1 Upper Limit	(-1500)-1500	Volts	1	A
48	P.S.1 Lower Limit	(-1500)-1500	Volts	1	A
	-to-				
59	P.S.10 Upper Limit	(-1500)-1500	Volts	1	A
5A	P.S.10 Lower Limit	(-1500)-1500	Volts	1	A

A.8 Maintenance Thresholds (DME/P, cont'd) LU#2A

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	DME/P Equipment 2				
5B	Transmission Rate	0-6000	Pulse Pairs	0	A
5C	Interrogation Pulse Code Rejection	0-100	dB	1	A
5D	Reply Pulse Partial Rise Time	0-50	uS	2	A
5E	Reply Delay PFE (IA Mode) Upper Limit	0-100	uS	2	A
5F	Reply Delay PFE (IA Mode) Lower Limit	(-100)-0	uS	2	A
60	Reply Delay PFE (FA Mode) Upper Limit	0-100	uS	3	A
61	Reply Delay PFE (FA Mode) Lower Limit	(-100)-0	uS	3	A
62	Reply Delay CMN (IA Mode) Upper Limit	0-10	uS	2	A
63	Reply Delay CMN (IA Mode) Lower Limit	(-10)-0	uS	2	A
64	Reply Delay CMN (FA Mode) Upper Limit	0-10	uS	2	A
65	Reply Delay CMN (FA Mode) Lower Limit	(-10)-0	uS	2	A
66	Reply ERP Transmitter Power Upper Lim	0-100	dB	1	A
67	Reply ERP Transmitter Power Lower Lim	(-100)-0	dB	1	A
68	Reply Efficiency (IA Mode)	0-100	%	0	A
69	Reply Efficiency (FA Mode)	0-100	%	0	A
6A	Synthesizer Frequency Lock Upper Lim	0-250	kHz	1	A
6B	Synthesizer Frequency Lock Lower Lim	(-250)-0	kHz	1	A
6C	Reply Pulse Code Error Upper Limit	0-500	uS	3	A
6D	Reply Pulse Code Error Lower Limit	(-500)-0	uS	3	A
6E	20 Spare	-	-	-	-
81		-	-	-	-
	Power Supply Voltages:				
82	P.S.1 Upper Limit	(-1500)-1500	Volts	1	A
83	P.S.1 Lower Limit	(-1500)-1500	Volts	1	A
	-to-				
94	P.S.10 Upper Limit	(-1500)-1500	Volts	1	A
95	P.S.10 Lower Limit	(-1500)-1500	Volts	1	A

A.9 Environmental Thresholds LU#2B

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	Azimuth Equipment 1				
20	Battery Case Over Temperature	(-50)-70	Degrees C	0	A
21	Battery Case Under Temperature	(-50)-70	Degrees C	0	A
22	Equipment Enclosure Temp Upper	(-50)-70	Degrees C	0	A
23	Equipment Enclosure Temp Lower	(-50)-70	Degrees C	0	A
24	10 Spare	-	-	-	-
2D		-	-	-	-
	Azimuth Equipment 2				
2E	Battery Case Over Temperature	(-50)-70	Degrees C	0	A
2F	Battery Case Under Temperature	(-50)-70	Degrees C	0	A
30	Equipment Enclosure Temp Upper	(-50)-70	Degrees C	0	A
31	Equipment Enclosure Temp Lower	(-50)-70	Degrees C	0	A
32	10 Spare	-	-	-	-
3B		-	-	-	-
	Elevation Equipment 1				
3C	Battery Case Over Temperature	(-50)-70	Degrees C	0	A
3D	Battery Case Under Temperature	(-50)-70	Degrees C	0	A
3E	Equipment Enclosure Temp Upper	(-50)-70	Degrees C	0	A
3F	Equipment Enclosure Temp Lower	(-50)-70	Degrees C	0	A
40	10 Spare	-	-	-	-
49		-	-	-	-
	Elevation Equipment 2				
4A	Battery Case Over Temperature	(-50)-70	Degrees C	0	A
4B	Battery Case Under Temperature	(-50)-70	Degrees C	0	A
4C	Equipment Enclosure Temp Upper	(-50)-70	Degrees C	0	A
4D	Equipment Enclosure Temp Lower	(-50)-70	Degrees C	0	A
4E	10 Spare	-	-	-	-
57		-	-	-	-

A.9 Environmental Thresholds (cont'd) LU#2B

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	DME/P Equipment 1				
58	Battery Case Over Temperature	(-50)-70	Degrees C	0	A
59	Battery Case Under Temperature	(-50)-70	Degrees C	0	A
5A	Equipment Enclosure Temp Upper	(-50)-70	Degrees C	0	A
5B	Equipment Enclosure Temp Lower	(-50)-70	Degrees C	0	A
5C	10 Spare	-	-	-	-
65		-	-	-	-
	DME/P Equipment 2				
66	Battery Case Over Temperature	(-50)-70	Degrees C	0	A
67	Battery Case Under Temperature	(-50)-70	Degrees C	0	A
68	Equipment Enclosure Temp Upper	(-50)-70	Degrees C	0	A
69	Equipment Enclosure Temp Lower	(-50)-70	Degrees C	0	A
6A	10 Spare	-	-	-	-
73		-	-	-	-

A.10 Diagnostics Results LU#2C

When diagnostics are performed on an equipment the results are stored in this logical unit. The equipment is identified by the Failed Parameter LU# and data point#. When a value of '0' is given for the LRU# or LU# in the 'VALUE' field this indicates that no LRU or Failed Parameter is identified.

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
20	First Candidate Failed LRU	0-600	LRU#	0	A
21	Second Candidate Failed LRU	0-600	LRU#	0	A
22	Third Candidate Failed LRU	0-600	LRU#	0	A
23	Failed Parameter 1	0-255	LU#	0	A
24		0-255	Data point#	0	A
25	Failed Parameter 2	0-255	LU#	0	A
26		0-255	Data point#	0	A
27	Failed Parameter 3	0-255	LU#	0	A
28		0-255	Datapoint#	0	A
29	Time of Occurrence	1989-2100	Year	0	A
2A		1-12	Month	0	A
2B		1-31	Day	0	A
2C		0-24	Hour	0	A
2D		0-60	Minute	0	A

A.11 Basic Data Words LU#2D

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	Basic Data Word 1				
20	App Azimuth to Threshold Distance	0-6300	m	0	A
21	App Azimuth Proportional Coverage Limit	(-60)-0	Degrees	0	A
22	App Azimuth Proportional Coverage Limit	0-60	Degrees	0	A
23	Clearance Signal Type		Pulse	0	A
			SB	0	A
	Basic Data Word 2				
24	Minimum Glide Path	0-150	Degrees	1	A
25	Back Azimuth Status	1 =	Not Available	0	A
		2 =	Normal Mode	0	A
26	DME Status	1 =	Not Available	0	A
		2 =	IA or DME/N	0	A
		3 =	FA Standard 1	0	A
		4 =	FA Standard 2	0	A
27	App Azimuth Status	1 =	Not Available	0	A
		2 =	Normal Mode	0	A
28	App Elevation Status	1 =	Not Available	0	A
		2 =	Normal Mode	0	A
	Basic Data Word 3				
29	App Azimuth Beamwidth	0-40	Degrees	1	A
2A	App Elevation Beamwidth	0-25	Degrees	1	A
2B	DME Distance	0-63875	m	1	A
	Basic Data Word 4				
2C	App Azimuth Magnetic Orientation	0-359	Degrees	0	A
2D	Back Azimuth Magnetic Orientation	0-359	Degrees	0	A
	Basic Data Word 5				
2E	Back Azimuth Proportional Limit	(-40)-0	Degrees	0	A
2F	Back Azimuth Proportional Limit	0-40	Degrees	0	A
30	Back Azimuth Beamwidth	0-40	Degrees	1	A
31	Back Azimuth Status	1 =	Not Available	0	A
		2 =	Normal Mode	0	A
	Basic Data Word 6				
32	Identification Character 2	A-Z	Character	ASCII	A
33	Identification Character 3	A-Z	Character	ASCII	A
34	Identification Character 4	A-Z	Character	ASCII	A

A.12 Auxiliary Data Words LH#2E

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	Auxiliary Data Word A1				
20	App Azimuth Antenna Offset	(-511)-511	m	0	A
21	App Azimuth to MLS Datum Point Distance	0-8191	m	0	A
22	App Azimuth antenna alignment	(-2050)-2050	Degrees	2	A
23	App Azimuth Antenna Coordinate System	1 =	Conical	0	A
		2 =	Planar	0	A
24	App Azimuth Antenna Height	(-63)-63	m	0	A
	Auxiliary Data Word A2				
25	App Elevation Antenna Offset	(-511)-511	m	0	A
26	MLS Datum Point to Threshold Distance	0-1023	m	0	A
27	App Elevation Antenna Height	(-63)-63	m	1	A
28	MLS Datum Point Elevation	(-4095)-4094	m	0	A
29	Runway Threshold Height	(-63)-63	m	0	A
	Auxiliary Data Word A3				
2A	DME Offset	(-2047)-2074	m	0	A
2B	DME to MLS Datum Point Distance	(-8191)-8191	m	0	A
2C	DME Antenna Height	(-63)-63	m	0	A
2D	Runway Stopend Distance	0-16383	m	0	A
	Auxiliary Data Word A4				
2E	Back Azimuth Antenna Offset	(-511)-	m	0	A
2F	Back Azimuth to MLS Datum Point Dist	0-2047	m	0	A
30	Back Azimuth Antenna Alignment	(-2050)-2050	Degrees	2	A
31	Back Azimuth Antenna Coord System	1 =	Conical	0	A
		2 =	Planar	0	A
32	Back Azimuth Antenna Height	(-63)-63	m	0	A
	Auxiliary Data Word A5				
33	RVR Touchdown Zone	0-2555	m	0	A
34	RVR (midpoint)	0-2555	m	0	A
35	RVR (stopend)	0-2555	m	0	A
36	Surface Wind Speed	0-127	knots	0	A
37	Surface Wind Direction (magnetic)	0-359	Degrees	0	A

Non Essential Auxiliary Data Words

The contents of Non Essential Auxiliary Data Words are not defined. For future use 7 data points have been reserved for each of 30 data words as follows:

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
Spare Non Essential Auxiliary Data Word 1					
20	Aux Data Word Type (A, B, or C)	A-C	Word Type	ASCII	A
21	Aux Data Word Number	1-64	Word#	0	A
22	Numeric Data	(-32768) - 32767	TBD	TBD	A
23	Numeric Data	(-32768) - 32767	TBD	TBD	A
24	Numeric Data	(-32768) - 32767	TBD	TBD	A
25	Numeric Data	(-32768) - 32767	TBD	TBD	A
26	Numeric Data	(-32768) - 32767	TBD	TBD	A
	-- TO --				
Spare Non Essential Auxiliary Data Word 30					
EB	Aux Data Word Type (A, B, or C)	A-C	Word Type	ASCII	A
EC	Aux Data Word Number	1-64	Word#	0	A
ED	Numeric Data	(-32768) - 32767	TBD	TBD	A
EE	Numeric Data	(-32768) - 32767	TBD	TBD	A
EF	Numeric Data	(-32768) - 32767	TBD	TBD	A
F0	Numeric Data	(-32768) - 32767	TBD	TBD	A
F1	Numeric Data	(-32768) - 32767	TBD	TBD	A

A.13 Record of Events(1) LU#30

Integrity Alarm and Secondary Alert conditions stored in the Record of Events(1) LU are identified by each out of tolerance parameter's LU# and ID. Alarm and Alert parameters are all contained in one logical unit for MLS, LU# 24H. A LU# and ID equal to zero indicates that data are not available. This could occur due to no fault history or following system initialization.

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	Integrity Alarms and Secondary Alerts (10 is the latest)				
20	Parameter 1	0-255	LU#	0	A
21		0-255	Datapoint#	0	A
22		1989-2100	Year	0	A
23		1-12	Month	0	A
24		1-31	Day	0	A
25		0-24	Hour	0	A
26		0-60	Minute	0	A
27	Parameter 2	0-255	LU#	0	A
28		0-255	Datapoint#	0	A
29		1989-2100	Year	0	A
2A		1-12	Month	0	A
2B		1-31	Day	0	A
2C		0-24	Hour	0	A
2D		0-60	Minute	0	A
2E	Parameter 3	0-255	LU#	0	A
2F		0-255	Datapoint#	0	A
30		1989-2100	Year	0	A
31		1-12	Month	0	A
32		1-31	Day	0	A
33		0-24	Hour	0	A
34		0-60	Minute	0	A
35	Parameter 4	0-255	LU#	0	A
36		0-255	Datapoint#	0	A
37		1989-2100	Year	0	A
38		1-12	Month	0	A
39		1-31	Day	0	A
3A		0-24	Hour	0	A
3B		0-60	Minute	0	A
3C	Parameter 5	0-255	LU#	0	A
3D		0-255	Datapoint#	0	A
3E		1989-2100	Year	0	A
3F		1-12	Month	0	A
40		1-31	Day	0	A
41		0-24	Hour	0	A
42		0-60	Minute	0	A

A.13 Record of Events(1) (cont'd) LU#30

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	Integrity Alarms and Secondary Alerts (10 is the latest)				
43	Parameter 6	0-255	LU#	0	A
44		0-255	Datapoint#	0	A
45		1989-2100	Year	0	A
46		1-12	Month	0	A
47		1-31	Day	0	A
48		0-24	Hour	0	A
49		0-60	Minute	0	A
4A	Parameter 7	0-255	LU#	0	A
4B		0-255	Datapoint#	0	A
4C		1989-2100	Year	0	A
4D		1-12	Month	0	A
4E		1-31	Day	0	A
4F		0-24	Hour	0	A
50		0-60	Minute	0	A
51	Parameter 8	0-255	LU#	0	A
52		0-255	Datapoint#	0	A
53		1989-2100	Year	0	A
54		1-12	Month	0	A
55		1-31	Day	0	A
56		0-24	Hour	0	A
57		0-60	Minute	0	A
58	Parameter 9	0-255	LU#	0	A
59		0-255	Datapoint#	0	A
5A		1989-2100	Year	0	A
5B		1-12	Month	0	A
5C		1-31	Day	0	A
5D		0-24	Hour	0	A
5E		0-60	Minute	0	A
5F	Parameter 10	0-255	LU#	0	A
60		0-255	Datapoint#	0	A
61		1989-2100	Year	0	A
62		1-12	Month	0	A
63		1-31	Day	0	A
64		0-24	Hour	0	A
65		0-60	Minute	0	A

A.13 Record of Events(2) LU#31

Maintenance warning conditions stored in the Record of Events(2) LU are identified by each failed parameter's LU# and ID. These warnings are contained in logical units 25H and 26H for MLS. A LU# and ID equal to zero indicates that data are not available. This could occur due to no fault history or following system initialization.

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	Maintenance Alarms (10 is the latest)				
20	Parameter 1	0-255	LU#	0	A
21		0-255	Datapoint#	0	A
22		1989-2100	Year	0	A
23		1-12	Month	0	A
24		1-31	Day	0	A
25		0-24	Hour	0	A
26		0-60	Minute	0	A
27	Parameter 2	0-255	LU#	0	A
28		0-255	Datapoint#	0	A
29		1989-2100	Year	0	A
2A		1-12	Month	0	A
2B		1-31	Day	0	A
2C		0-24	Hour	0	A
2D		0-60	Minute	0	A
2E	Parameter 3	0-255	LU#	0	A
2F		0-255	Datapoint#	0	A
30		1989-2100	Year	0	A
31		1-12	Month	0	A
32		1-31	Day	0	A
33		0-24	Hour	0	A
34		0-60	Minute	0	A
35	Parameter 4	0-255	LU#	0	A
36		0-255	Datapoint#	0	A
37		1989-2100	Year	0	A
38		1-12	Month	0	A
39		1-31	Day	0	A
3A		0-24	Hour	0	A
3B		0-60	Minute	0	A
3C	Parameter 5	0-255	LU#	0	A
3D		0-255	Datapoint#	0	A
3E		1989-2100	Year	0	A
3F		1-12	Month	0	A
40		1-31	Day	0	A
41		0-24	Hour	0	A
42		0-60	Minute	0	A

A.13 Record of Events(2) (cont'd) LU#31

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	Maintenance Alarms (10 is the latest)				
43	Parameter 6	0-255	LU#	0	A
44		0-255	Datapoint#	0	A
45		1989-2100	Year	0	A
46		1-12	Month	0	A
47		1-31	Day	0	A
48		0-24	Hour	0	A
49		0-60	Minute	0	A
4A	Parameter 7	0-255	LU#	0	A
4B		0-255	Datapoint#	0	A
4C		1989-2100	Year	0	A
4D		1-12	Month	0	A
4E		1-31	Day	0	A
4F		0-24	Hour	0	A
50		0-60	Minute	0	A
51	Parameter 8	0-255	LU#	0	A
52		0-255	Datapoint#	0	A
53		1989-2100	Year	0	A
54		1-12	Month	0	A
55		1-31	Day	0	A
56		0-24	Hour	0	A
57		0-60	Minute	0	A
58	Parameter 9	0-255	LU#	0	A
59		0-255	Datapoint#	0	A
5A		1989-2100	Year	0	A
5B		1-12	Month	0	A
5C		1-31	Day	0	A
5D		0-24	Hour	0	A
5E		0-60	Minute	0	A
5F	Parameter 10	0-255	LU#	0	A
60		0-255	Datapoint#	0	A
61		1989-2100	Year	0	A
62		1-12	Month	0	A
63		1-31	Day	0	A
64		0-24	Hour	0	A
65		0-60	Minute	0	A

A.13 Record of Events(3) LU#32

Records of individual State Changes are identified by their LU# and ID. State Change parameters are contained in two logical units for MLS, LU# 20H and 21H.

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	MLS State Changes (10 is the latest)				
20	State Change 1	0-255	LU#	0	A
21		0-255	Datapoint#	0	A
22		1989-2100	Year	0	A
23		1-12	Month	0	A
24		1-31	Day	0	A
25		0-24	Hour	0	A
26		0-60	Minute	0	A
27	State Change 2	0-255	LU#	0	A
28		0-255	Datapoint#	0	A
29		1989-2100	Year	0	A
2A		1-12	Month	0	A
2B		1-31	Day	0	A
2C		0-24	Hour	0	A
2D		0-60	Minute	0	A
2E	State Change 3	0-255	LU#	0	A
2F		0-255	Datapoint#	0	A
30		1989-2100	Year	0	A
31		1-12	Month	0	A
32		1-31	Day	0	A
33		0-24	Hour	0	A
34		0-60	Minute	0	A
35	State Change 4	0-255	LU#	0	A
36		0-255	Datapoint#	0	A
37		1989-2100	Year	0	A
38		1-12	Month	0	A
39		1-31	Day	0	A
3A		0-24	Hour	0	A
3B		0-60	Minute	0	A
3C	State Change 5	0-255	LU#	0	A
3D		0-255	Datapoint#	0	A
3E		1989-2100	Year	0	A
3F		1-12	Month	0	A
40		1-31	Day	0	A
41		0-24	Hour	0	A
42		0-60	Minute	0	A

A.13 Record of Events(3) (cont'd) LU#32

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	MLS State Changes (10 is the latest)				
43	State Change 6	0-255	LU#	0	A
44		0-255	Datapoint#	0	A
45		1989-2100	Year	0	A
46		1-12	Month	0	A
47		1-31	Day	0	A
48		0-24	Hour	0	A
49		0-60	Minute	0	A
4A	State Change 7	0-255	LU#	0	A
4B		0-255	Datapoint#	0	A
4C		1989-2100	Year	0	A
4D		1-12	Month	0	A
4E		1-31	Day	0	A
4F		0-24	Hour	0	A
50		0-60	Minute	0	A
51	State Change 8	0-255	LU#	0	A
52		0-255	Datapoint#	0	A
53		1989-2100	Year	0	A
54		1-12	Month	0	A
55		1-31	Day	0	A
56		0-24	Hour	0	A
57		0-60	Minute	0	A
58	State Change 9	0-255	LU#	0	A
59		0-255	Datapoint#	0	A
5A		1989-2100	Year	0	A
5B		1-12	Month	0	A
5C		1-31	Day	0	A
5D		0-24	Hour	0	A
5E		0-60	Minute	0	A
5F	State Change 10	0-255	LU#	0	A
60		0-255	Datapoint#	0	A
61		1989-2100	Year	0	A
62		1-12	Month	0	A
63		1-31	Day	0	A
64		0-24	Hour	0	A
65		0-60	Minute	0	A

A.13 Record of Events(4) LU#33

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	MLS Diagnostics Results (10 is the latest)				
	Diagnostics Result 1				
20	First Candidate Failed LRU	0-600	LRU#	0	A
21	Second Candidate Failed LRU	0-600	LRU#	0	A
22	Third Candidate Failed LRU	0-600	LRU#	0	A
23	Failed Parameter 1	0-255	LU#	0	A
24		0-255	Data point#	0	A
25	Failed Parameter 2	0-255	LU#	0	A
26		0-255	Data point#	0	A
27	Failed Parameter 3	0-255	LU#	0	A
28		0-255	Data point#	0	A
	Time of Occurrence	1989-			
29		2100	Year	0	A
2A		1-12	Month	0	A
2B		1-31	Day	0	A
2C		0-24	Hour	0	A
2D		0-60	Minute	0	A
	Diagnostics Result 2				
2E	First Candidate Failed LRU	0-600	LRU#	0	A
2F	Second Candidate Failed LRU	0-600	LRU#	0	A
30	Third Candidate Failed LRU	0-600	LRU#	0	A
31	Failed Parameter 1	0-255	LU#	0	A
32		0-255	Data point#	0	A
33	Failed Parameter 2	0-255	LU#	0	A
34		0-255	Data point#	0	A
35	Failed Parameter 3	0-255	LU#	0	A
36		0-255	Data point#	0	A
	Time of Occurrence	1989-			
37		2100	Year	0	A
38		1-12	Month	0	A
39		1-31	Day	0	A
3A		0-24	Hour	0	A
3B		0-60	Minute	0	A

A.13 Record of Events(4) (cont'd) LU#33

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	MLS Diagnostics Results (10 is the latest)				
	Diagnostics Result 3				
3C	First Candidate Failed LRU	0-600	LRU#	0	A
3D	Second Candidate Failed LRU	0-600	LRU#	0	A
3E	Third Candidate Failed LRU	0-600	LRU#	0	A
3F	Failed Parameter 1	0-255	LU#	0	A
40		0-255	Data point#	0	A
41	Failed Parameter 2	0-255	LU#	0	A
42		0-255	Data point#	0	A
43	Failed Parameter 3	0-255	LU#	0	A
44		0-255	Data point#	0	A
	Time of Occurrence	1989-			
45		2100	Year	0	A
46		1-12	Month	0	A
47		1-31	Day	0	A
48		0-24	Hour	0	A
49		0-60	Minute	0	A
	Diagnostics Result 4				
4A	First Candidate Failed LRU	0-600	LRU#	0	A
4B	Second Candidate Failed LRU	0-600	LRU#	0	A
4C	Third Candidate Failed LRU	0-600	LRU#	0	A
4D	Failed Parameter 1	0-255	LU#	0	A
4E		0-255	Data point#	0	A
4F	Failed Parameter 2	0-255	LU#	0	A
50		0-255	Data point#	0	A
51	Failed Parameter 3	0-255	LU#	0	A
52		0-255	Data point#	0	A
	Time of Occurrence	1989-			
53		2100	Year	0	A
54		1-12	Month	0	A
55		1-31	Day	0	A
56		0-24	Hour	0	A
57		0-60	Minute	0	A

A.13 Record of Events(4) (cont'd) LU#33

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	MLS Diagnostics Results (10 is the latest)				
	Diagnostics Result 5				
58	First Candidate Failed LRU	0-600	LRU#	0	A
59	Second Candidate Failed LRU	0-600	LRU#	0	A
5A	Third Candidate Failed LRU	0-600	LRU#	0	A
5B	Failed Parameter 1	0-255	LU#	0	A
5C		0-255	Data point#	0	A
5D	Failed Parameter 2	0-255	LU#	0	A
5E		0-255	Data point#	0	A
5F	Failed Parameter 3	0-255	LU#	0	A
60		0-255	Data point#	0	A
	Time of Occurrence	1989-2100	Year	0	A
61		1-12	Month	0	A
62		1-31	Day	0	A
63		0-24	Hour	0	A
64		0-60	Minute	0	A
65					
	Diagnostics Result 6				
66	First Candidate Failed LRU	0-600	LRU#	0	A
67	Second Candidate Failed LRU	0-600	LRU#	0	A
68	Third Candidate Failed LRU	0-600	LRU#	0	A
69	Failed Parameter 1	0-255	LU#	0	A
6A		0-255	Data point#	0	A
6B	Failed Parameter 2	0-255	LU#	0	A
6C		0-255	Data point#	0	A
6D	Failed Parameter 3	0-255	LU#	0	A
6E		0-255	Data point#	0	A
	Time of Occurrence	1989-2100	Year	0	A
6F		1-12	Month	0	A
70		1-31	Day	0	A
71		0-24	Hour	0	A
72		0-60	Minute	0	A
73					

A.13 Record of Events(4) (cont'd) LU#33

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	MLS Diagnostics Results (10 is the latest)				
	Diagnostics Result 7				
74	First Candidate Failed LRU	0-600	LRU#	0	A
75	Second Candidate Failed LRU	0-600	LRU#	0	A
76	Third Candidate Failed LRU	0-600	LRU#	0	A
77	Failed Parameter 1	0-255	LU#	0	A
78		0-255	Data point#	0	A
79	Failed Parameter 2	0-255	LU#	0	A
7A		0-255	Data point#	0	A
7B	Failed Parameter 3	0-255	LU#	0	A
7C		0-255	Data point#	0	A
	Time of Occurrence	1989-			
7D		2100	Year	0	A
7E		1-12	Month	0	A
7F		1-31	Day	0	A
80		0-24	Hour	0	A
81		0-60	Minute	0	A
	Diagnostics Result 8				
82	First Candidate Failed LRU	0-600	LRU#	0	A
83	Second Candidate Failed LRU	0-600	LRU#	0	A
84	Third Candidate Failed LRU	0-600	LRU#	0	A
85	Failed Parameter 1	0-255	LU#	0	A
86		0-255	Data point#	0	A
87	Failed Parameter 2	0-255	LU#	0	A
88		0-255	Data point#	0	A
89	Failed Parameter 3	0-255	LU#	0	A
8A		0-255	Data point#	0	A
	Time of Occurrence	1989-			
8B		2100	Year	0	A
8C		1-12	Month	0	A
8D		1-31	Day	0	A
8E		0-24	Hour	0	A
8F		0-60	Minute	0	A

A.13 Record of Events(4) (cont'd) LU#33

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	MLS Diagnostics Results (10 is the latest)				
	Diagnostics Result 9				
90	First Candidate Failed LRU	0-600	LRU#	0	A
91	Second Candidate Failed LRU	0-600	LRU#	0	A
92	Third Candidate Failed LRU	0-600	LRU#	0	A
93	Failed Parameter 1	0-255	LU#	0	A
94		0-255	Data point#	0	A
95	Failed Parameter 2	0-255	LU#	0	A
96		0-255	Data point#	0	A
97	Failed Parameter 3	0-255	LU#	0	A
98		0-255	Data point#	0	A
	Time of Occurrence	1989-			
99		2100	Year	0	A
9A		1-12	Month	0	A
9B		1-31	Day	0	A
9C		0-24	Hour	0	A
9D		0-60	Minute	0	A
	Diagnostics Result 10				
9E	First Candidate Failed LRU	0-600	LRU#	0	A
9F	Second Candidate Failed LRU	0-600	LRU#	0	A
A0	Third Candidate Failed LRU	0-600	LRU#	0	A
A1	Failed Parameter 1	0-255	LU#	0	A
A2		0-255	Data point#	0	A
A3	Failed Parameter 2	0-255	LU#	0	A
A4		0-255	Data point#	0	A
A5	Failed Parameter 3	0-255	LU#	0	A
A6		0-255	Data point#	0	A
	Time of Occurrence	1989-			
A7		2100	Year	0	A
A8		1-12	Month	0	A
A9		1-31	Day	0	A
AA		0-24	Hour	0	A
AB		0-60	Minute	0	A

A.14 Historical Performance Records LU#40-70

Historical Performance Record Logical Units collectively contain 8 sets of periodic recordings of all Integrity and Secondary Parameters, Maintenance Parameters, Environmental Parameters and State Changes (RMS Master LU and Terminal LU) along with the time and date of each data set recording (timestamp). The Historical Records are contained in Logical Units in the same format as the current records (See Appendices A.5, A.6, A.3, A.1 and A.2 respectively). The timestamps are contained in a single LU for all 8 performance records. The LU numbers shall be allocated to the Historical Performance Records as follows:

Historical Performance Record Timestamps LU#40

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
	Historical Performance Record Timestamps (8 is the latest)				
20	Timestamp 1	1989-			
21		2100	Year	0	A
22		1-12	Month	0	A
23		1-31	Day	0	A
24		0-24	Hour	0	A
25		0-60	Minute	0	A
26	Timestamp 2	1989-			
27		2100	Year	0	A
28		1-12	Month	0	A
29		1-31	Day	0	A
2A		0-24	Hour	0	A
2B		0-60	Minute	0	A
2C	Timestamp 3	1989-			
2D		2100	Year	0	A
2E		1-12	Month	0	A
2F		1-31	Day	0	A
30		0-24	Hour	0	A
31		0-60	Minute	0	A
32	Timestamp 4	1989-			
33		2100	Year	0	A
34		1-12	Month	0	A
35		1-31	Day	0	A
36		0-24	Hour	0	A
37		0-60	Minute	0	A
38	Timestamp 5	1989-			
39		2100	Year	0	A
3A		1-12	Month	0	A
3B		1-31	Day	0	A
3C		0-24	Hour	0	A
3D		0-60	Minute	0	A

A.14 Historical Performance Records (cont'd) LU#40-70

Historical Performance Timestamps (cont'd)
(8 is the latest)

ID	DESCRIPTION	VALUE	UNITS	SCALE	CONDIT STATUS
3E	Timestamp 6	1989-			
3F		2100	Year	0	A
40		1-12	Month	0	A
41		1-31	Day	0	A
42		0-24	Hour	0	A
43		0-60	Minute	0	A
44	Timestamp 7	1989-			
45		2100	Year	0	A
46		1-12	Month	0	A
47		1-31	Day	0	A
48		0-24	Hour	0	A
49		0-60	Minute	0	A
4A	Timestamp 8	1989-			
4B		2100	Year	0	A
4C		1-12	Month	0	A
4D		1-31	Day	0	A
4E		0-24	Hour	0	A
4F		0-60	Minute	0	A

Record #1

Integrity and Secondary Parameters (A.5)	LU#41
Maintenance Parameters (A.6)	LU#42
	LU#43
Environmental Parameters (A.3)	LU#44
RMS Master State Changes (A.1)	LU#45
Terminal State Changes (A.2)	LU#46

Record #2

Integrity and Secondary Parameters (A.5)	LU#47
Maintenance Parameters (A.6)	LU#48
	LU#49
Environmental Parameters (A.3)	LU#4A
RMS Master State Changes (A.1)	LU#4B
Terminal State Changes (A.2)	LU#4C

Record #3

Integrity and Secondary Parameters (A.5)	LU#4D
Maintenance Parameters (A.6)	LU#4E
	LU#4F
Environmental Parameters (A.3)	LU#50
RMS Master State Changes (A.1)	LU#51
Terminal State Changes (A.2)	LU#52

A.14 Historical Performance Records (cont'd) LU#40-70

Record #4

Integrity and Secondary Parameters (A.5)	LU#53
Maintenance Parameters (A.6)	LU#54
	LU#55
Environmental Parameters (A.3)	LU#56
RMS Master State Changes (A.1)	LU#57
Terminal State Changes (A.2)	LU#58

Record #5

Integrity and Secondary Parameters (A.5)	LU#59
Maintenance Parameters (A.6)	LU#5A
	LU#5B
Environmental Parameters (A.3)	LU#5C
RMS Master State Changes (A.1)	LU#5D
Terminal State Changes (A.2)	LU#5E

Record #6

Integrity and Secondary Parameters (A.5)	LU#5F
Maintenance Parameters (A.6)	LU#60
	LU#61
Environmental Parameters (A.3)	LU#62
RMS Master State Changes (A.1)	LU#63
Terminal State Changes (A.2)	LU#64

Record #7

Integrity and Secondary Parameters (A.5)	LU#65
Maintenance Parameters (A.6)	LU#66
	LU#67
Environmental Parameters (A.3)	LU#68
RMS Master State Changes (A.1)	LU#69
Terminal State Changes (A.2)	LU#6A

Record #8 (Record #8 represents the latest recording)

Integrity and Secondary Parameters (A.5)	LU#6B
Maintenance Parameters (A.6)	LU#6C
	LU#6D
Environmental Parameters (A.3)	LU#6E
RMS Master State Changes (A.1)	LU#6F
Terminal State Changes (A.2)	LU#70

A.15 Equipment Control LU#80

ID	DESCRIPTION	VALUE		UNITS	SCALE	CONDIT STATUS
20	Azimuth	1	=	Azimuth #1	0	A
		2	=	Azimuth #2	0	A
21	Elevation	1	=	Elevation #1	0	A
		2	=	Elevation #2	0	A
22	DME/P	1	=	DME/P #1	0	A
		2	=	DME/P #2	0	A
23	MLS	1	=	RMS	0	A
		2	=	System	0	A

APPENDIX B MLS CERTIFICATION

Appendix B MLS Certification

B.1 Certification Parameters - This appendix contains guidance material for the development of remote certification procedures at the MPS and is included in this report for information purposes only. Remote certification of the MLS is an RMMS operational requirement and will consist of the acquisition and processing of MLS RMS data and the execution of several commands. The MLS RMS certification parameters will include:

LU#	LU Title	Description
LU#20	RMS Master	Provides equipment status and configuration information.
LU#21	Terminal	Indicates the status of all portable terminal interfaces to the MLS.
LU#22	Environmental Parameters	The status of all monitored environmental parameters.
LU#24	Integrity and Secondary Parameters	The monitored parameter values.
LU#25 LU#26	Maintenance Parameters	The monitored parameter values.
LU#27	Integrity and Secondary Thresholds	The parameter fixed threshold values.
LU#28 LU#29 LU#2A	Maintenance Thresholds	The parameter fixed threshold values.
LU#2B	Environmental Thresholds	The parameter fixed threshold values.
LU#2D	Basic Data Words	Data word contents.
LU#2E LU#2F	Auxiliary Data Words	Data word contents.
LU#30-33	Record of Events	The last 10 integrity, secondary, maintenance and environmental alarms, and state changes.

B.2 Certification Commands - The commands to be executed for MLS certification will include:

Command	Purpose
Redesignate Primary Equipment Equipment Off Equipment On	To cause a dual equipment to switchover transmitters and effectively test the operation of the standby transmitter. These commands will be executed for each equipment in the MLS to be certified. The Redesignate command only renames the primary equipment. After executing, the equipment must then be turned Off (Equipment Off), then turned On (Equipment On) as the newly designated primary equipment will only radiate after initialization.
Initiate End-to End Check	To ensure that the equipment monitor is operating correctly and will cause the equipment to shutdown when erroneous guidance conditions are detected. This command will be executed for each equipment in the MLS to be certified.